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SUNWAY M PLUS

SINGLE-PHASE SOLAR INVERTER

USER MANUAL

-Installation and Programming Guide-

Issued on 25/08/11
R. 02
Applicable from SW Version 1.67

English

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1. GENERAL INFORMATION ON THE SUNWAY M PLUS INVERTER

This manual provides the installation instructions for the SUNWAY M PLUS inverters. Two levels of procedure are available: the BASIC and the ADVANCED one.

For the convenience of the user, the procedures for the inverter installation and configuration are divided into 4 sections:

- **BASIC INSTALLATION:** Describes the procedures to connect the main elements required for the operation of the system (PV generator and grid), inverter start-up and operation testing. The basic installation does not require any modification to the programming of the inverter.
- **ADVANCED INSTALLATION:** Describes the inverter's advanced functions (for expert users).
- **OPTIONS:** Describes all the options available on the inverter.
- **PROGRAMMING:** Provides the detailed description of the inverter's programming procedures.

1.1. Scope of this Manual

Elettronica Santerno undertakes to keep the technical documentation on its website santerno.com updated with the latest software version issued. Should you need any technical document related to earlier software versions, please contact Elettronica Santerno.

1.2. Description

Figure 1: Inverter of the SUNWAY M PLUS Series

The inverters of the SUNWAY M PLUS series are full-digital devices that convert DC energy produced by photovoltaic (PV) panels – when radiated by sunlight – into AC energy, which is delivered to the grid.

A solar system for the self-generation of electric power is composed of two elements:

- The PV generator, consisting of a set of PV panels.
- The SUNWAY M PLUS inverter, delivering power supply from the PV generator to the grid.

Operation in parallel to the grid allows users to exploit the power supply produced directly by the system when radiated by sunlight, and to deliver power which is not locally consumed to the grid, by conferring it to the Grid Administrator. Therefore, residual power can be used by other users connected to the grid, thus allowing the exploitation of the green energy produced by the PV generator, as well as the constant operation of the same PV generator at its max ratings for optimum performance.

At night-time or when sunlight is weak, users can exploit the grid to power their loads.

The inverters of the SUNWAY M PLUS series are thoroughly designed and manufactured in Italy by Elettronica Santerno SpA's technicians, and incorporate the most advanced features offered by the latest electronic technologies.

All the parameter values related to the operation of the equipment may be easily programmed through the display/keypad module, the alphanumeric display and the parameter menus and submenus.

The inverters of the SUNWAY M PLUS series have been designed and manufactured in compliance with the requirements of the "Low Voltage Directive" and the "Electromagnetic Compatibility Directive" and comply with the prescriptions for grid connection applying to self-generation electric plants.

1.3. Benefits

The main functions integrated as a standard in the SUNWAY M PLUS inverters are listed below:

- Wide range of supply voltages, 105 ÷ 420 (SUNWAY M PLUS 1300E), 156 ÷ 585 Vdc (SUNWAY M PLUS 2600E, 3600E, 4300E), 260-585 (other models); Possibility of connecting an additional PV field with supply voltage of 24 Vdc to 360 Vdc by enabling the 'Additional PV Field' option.
- Full-digital DC/AC conversion through 32-bit microprocessor obtained with PWM technique and IGBT bridge ensuring high efficiency, high reliability and low distortion of the grid current.
- Output toroidal transformer ensuring full isolation between the grid and the PV generator.
- Input filters and output filters for the suppression of conducted disturbance and radiated disturbance.
- Testing circuit to check the isolation resistance between the input and the ground.
- Robust metal enclosure for outdoor installation; Degree of protection IP54 and IP65.
- Operation in parallel to the grid, power factor=1.
- Possibility of acquiring up to three ambient variables through analogue inputs.
- Fast connection through quick-coupling MC4 connectors for the connection of up to four strings of the Main PV Field (PV1).
- Keypad allowing programming and controlling the inverter operation. It is provided with a back-lit LCD display (4x16 characters) to easily view the main data processed by the inverter.
- Serial link RS485 with Modbus protocol for remote control and programming via the Remote Sunway software (provided as an option).

1.4. Operating Principle

SUNWAY M PLUS is a photovoltaic inverter whose function is to convert the direct current produced by a PV generator in alternate current to be injected into the public grid.

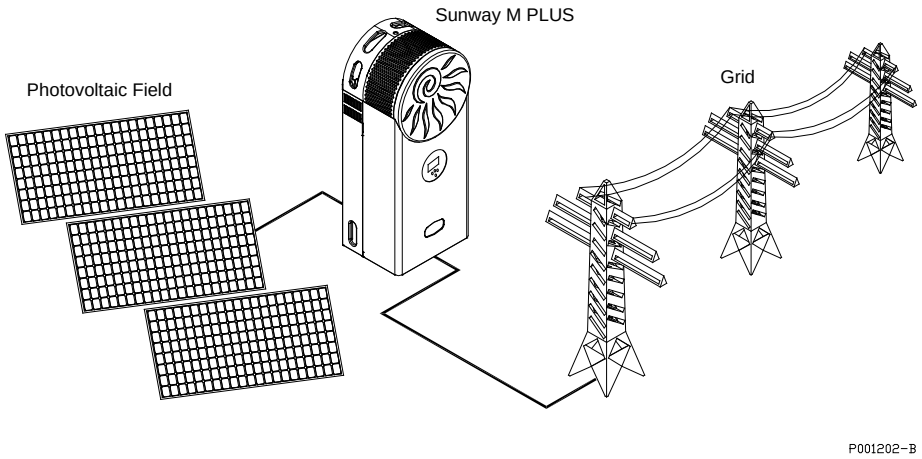


Figure 2: Diagram of a PV array equipped with a SUNWAY M PLUS inverter

Specifically, the power conversion system (inverter) is connected directly to the Main PV Field. Using a high-switching frequency IGBT bridge, the DC coming from the Main PV Field is converted into AC at the grid frequency. A high-efficiency toroidal transformer provides galvanic isolation between the grid and the Main PV Field to ensure safe operation.

The isolation sensor monitoring the isolation to ground of the PV panels is integrated into the equipment.

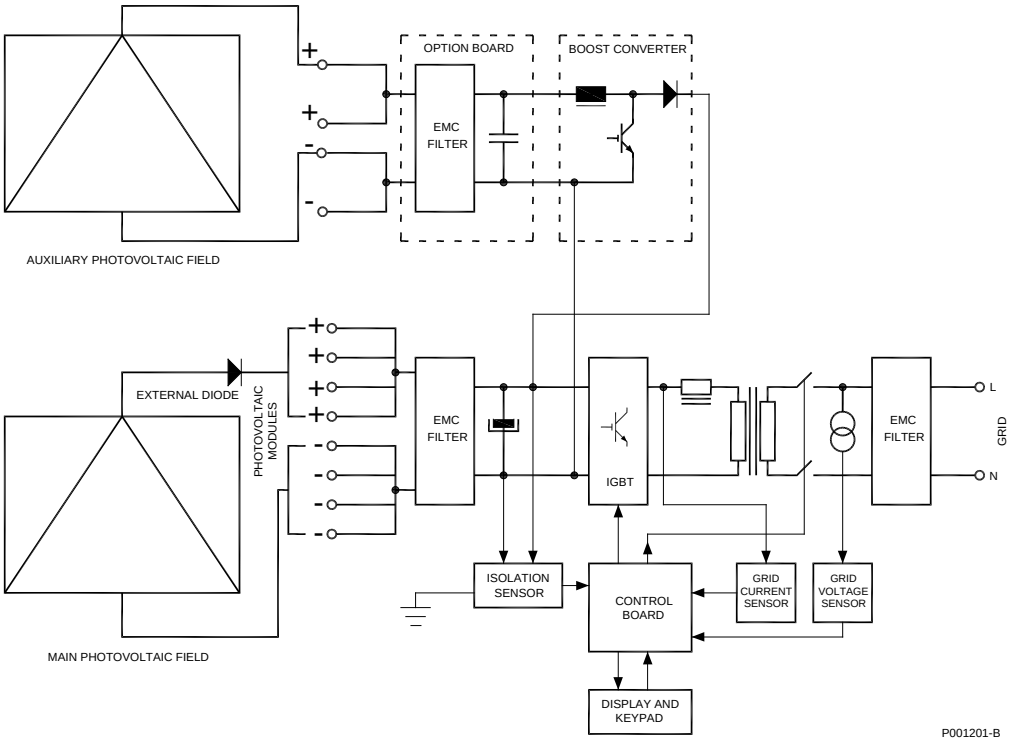


Figure 3: Basic operating diagram of the SUNWAY M PLUS

1.5. Main Standard Integrated Functions

This section contains a brief description of the equipment functions, to allow users who are not familiar with the operation of PV fields to better understand this manual.

Device for constant isolation control: This is a device which constantly checks the isolation between the ground and the polarities of the Main PV Field (see 2.6.2 Grid-connection Contactor). This function is obtained by measuring the isolation resistance: the equipment is factory-set to detect isolation loss when the isolation resistance between polarity + or polarity – and the ground drops below 1MΩ. To change the factory setting, please refer to section 5 PROGRAMMING.

MPPT (Maximum Power Point Tracking): A sophisticated computing performed by the microprocessor allows the inverter to detect the optimum operation point of the Main PV Field, corresponding to the max power that can be produced by the field depending on current solar radiation conditions.

Grid Disconnection Device: This device automatically disconnects the self-generation plant from the grid when parallel operation is no longer possible. This typically occurs when the grid 'opens' due to maintenance needs or to safety circuit trippings. This function allows the inverter to instantly disconnect from the grid, thus avoiding unwanted stand-alone operation of the plant and electrical shock hazards for the operators working on the grid. Trip times and levels are factory-set according to the applicable safety standards. To modify the factory settings, please refer to section 5 PROGRAMMING.

The ratings of this safety function have been certified as prescribed by the Grid Administrator.

When required by the Grid Administrator, a simple self-test procedure performed via display/keypad allows checking the efficiency of the grid disconnection device.

1.6. Optional Functions

The main optional functions for the SUNWAY M PLUS inverters are listed below:

- Additional PV Field (PV2). Device for the connection of an auxiliary photovoltaic field for full exploitation of the PV modules. Not applicable on model 1300E.
- Data Logger board for local data storage. Thanks to the three interfaces available (RS232, RS485, and Ethernet), the Data Logger allows connecting the inverter to a computer, to the LAN and to a router for connection to the Internet. It also allows using an analogue modem or a GSM/GPRS modem for the remote control of the equipment. A single Data Logger allows acquiring data from multiple devices interconnected via Modbus.
- Auxiliary power supply unit. The auxiliary power supply unit powers the control boards of the inverter even when solar radiation is insufficient. This is particularly useful to allow the constant remote control of the equipment.
- Ambient Sensors and Field I/Os Expansion Board for the acquisition of environmental signals. This additional platform allows controlling sensors with voltage output of 0-10V and 0-100mV and sensors with current output of 0-20mA. It also allows controlling PT100 RTD temperature sensors.
- Positive or Negative Earth, for the polarization of the positive pole of the Main PV Field to the ground.

Table 89: Options provides options-models compatibility information.

CAUTION

The options must be requested when ordering the equipment.

1.7. Documentation Provided with the Equipment

The SUNWAY M PLUS is provided with the following documents:

Document Name	Purpose
Installation and Programming Guide	Contains all the necessary information on transport, assembly, installation and maintenance and programming of the device. Available for download in PDF format from santerno.com
Quick Installation Guide	Contains the basic information for the inverter start-up. A paper copy is provided in the package. Alternatively, it can be downloaded in PDF format from santerno.com
Production Test Certificate	Contains all the information concerning the Production Test carried out on the device and its results
Certification and Grid Interface File	Contains the Declaration of Conformity relevant to the standards applicable to the device and information on the grid interface parameters. Available for download in PDF format from santerno.com

Table 1: Documentation provided with the equipment

1.7.1. Correct Storage of the Documentation

All the documents provided with the SUNWAY M PLUS should be kept for the duration of life of the equipment, together with the documentation of the PV plant. The documentation must always be easily accessible.

1.7.2. Production Test Certificate

The Production Test Certificate is issued by Elettronica Santerno SpA's technicians when carrying out the production tests on the SUNWAY M PLUS inverter. It contains all the information concerning the Production Test carried out on the device and its results.

1.8. Acronyms of the Electronic Boards

The table below provides the description of the acronyms used for the electronic boards.

Acronym	Description
ES821	CONTROL BOARD
ES847	AMBIENT SENSORS AND FIELD I/Os EXPANSION BOARD
ES851	DATA LOGGER BOARD

2. BASIC INSTALLATION

The basic installation consists in connecting the basic elements for system operation (grid and PV generator) in a plant equipped with only one PV generator and one inverter.

The other configuration possibilities offered by the SUNWAY M PLUS, both in its standard version and in the version with optional boards, are described under sections 3 ADVANCED INSTALLATION and 4 OPTIONS.

2.1. Important Safety Information

This section contains safety statements. The non-observance of these safety instructions may cause serious injury or death and failure to the equipment and any connected device. Carefully read the instructions below before installing, starting and operating the inverter.
Only qualified personnel is allowed to carry out the installation of the equipment (see 2.1.2 Qualified Service Personnel).

KEY TO SYMBOLS:

DANGER

Indicates operating procedures that, if not correctly performed, may cause serious injury or death due to electrical shock.

CAUTION

Indicates operating procedures that, if not respected, may cause serious equipment failure.

NOTE

Indicates important information concerning the operation of the equipment.

PROHIBITION

Prohibits the execution of specific operating procedures.

SAFETY STATEMENTS TO FOLLOW WHEN INSTALLING AND OPERATING THE EQUIPMENT:

NOTE

Always read this instruction manual entirely before starting the equipment.

DANGER

ALWAYS GROUND THE EQUIPMENT.

CAUTION

The SUNWAY M PLUS can be powered by a photovoltaic field only, and must be used exclusively for operation in parallel with the grid. Any other use is to be considered as improper.

2.1.1. Operating Precautions and Prohibitions

DANGER

ELECTRICAL SHOCK HAZARD

Never perform any operation on the equipment when it is powered.

EXPLOSION AND FIRE

Explosion and fire hazard exists if the equipment is installed in presence of flammable fumes. Do not install the inverter in places subject to explosion and fire hazard.

PROHIBITION

The product described in this manual is not designed to operate in environments with a potentially explosive atmosphere. Installation and use of the equipment in such environments is therefore prohibited.

PROHIBITION

Any electrical or mechanical changes inside the product are forbidden, even outside the warranty period.

Elettronica Santerno is not responsible for any risks that may arise for the product and people in case of tampering, changes or modifications not expressly authorized.

2.1.2. Qualified Service Personnel

Any operations on the SUNWAY M PLUS inverter shall be performed exclusively by qualified service personnel. 'Qualified personnel' means personnel who have undergone appropriate training for their task.

For the commissioning and operation of the SUNWAY M PLUS, said personnel must be trained on the content of the instructions for installation and use. In particular, compliance with the safety warnings is required.

2.1.3. Plant in Safety Conditions

Always attach the following panel at each of the disconnection devices of the PV field.

Figure 4: 'Plant in safety conditions' panel

CAUTION

Always ensure that all the dispositions provided in the section "Plant in Safety Conditions" have been implemented.

CAUTION

Before performing any operation inside the equipment, put it in safety conditions by turning it off and by opening the switches both on the DC and the AC side.

DANGER

After powering off the inverter, wait at least 10 minutes before opening the doors, to let the capacitors on the intermediate DC circuit to discharge.

NOTE

In case of malfunctions, contact Elettronica Santerno SpA's AFTER-SALES SERVICE for corrective actions.

2.1.4. Personal Protection Equipment (PPE)

The service personnel must be equipped with the following PPE, as prescribed by the European Directives and by the local implementations thereof.

SYMBOL		DESCRIPTION
	Glasses/face screen	During the entire intervention
	100 Volts insulating gloves	During the entire intervention
	Dielectric helmet	During the entire intervention
	Safety shoes/boots	During the entire intervention
	Tools	During the entire intervention
	Operators must be provided with a suitable communication means to be able to contact the national health system quickly in case of emergency.	

NOTE

It is recommended to perform the service operations with the system POWERED OFF and the equipment in safety conditions (see section 2.1.6 Electrical Connections: Safety Procedure).

2.1.5. Burns

Immediately after stopping the equipment, its components may be still subject to high temperatures.

All necessary precautions must be observed to avoid burns. Always wear protective gloves.

2.1.6. Electrical Connections: Safety Procedure

Before carrying out any operation inside the inverter, put the equipment in safety conditions by performing the following actions:

- Ensure the inverter is not running, i.e. that it is in its STOP status.
- Open the external switch on the grid side (AC).
- Disconnect the quick-coupling PV connectors on the PV field side (DC).
- Wait at least 10 minutes before starting to perform the service operations.

2.2. Delivery Check

Upon receipt of the product, make sure that the equipment is not damaged and that it complies with the equipment you ordered by referring to the nameplates described below. If the equipment is damaged, contact the supplier or the insurance company concerned. If the equipment does not comply with the one you ordered, please contact your supplier as soon as possible.

Figure 5: SUNWAY M PLUS unopened package

NOTE

The labels stating the codes and descriptions of the product and selected options may have different colours than the ones shown in the picture.

If the equipment is stored before being commissioned, make sure that the ambient conditions comply with the ratings specified by the Manufacturer (see section 2.4.1 Environmental Requirements for Equipment Storage and Transport).

The equipment warranty covers any manufacturing defect. The manufacturer is not responsible for possible damages due to transportation or unpacking. The manufacturer is not responsible for possible damages or faults caused by improper and irrational uses; wrong installation; improper conditions of temperature, humidity, or corrosive substances. The manufacturer is not responsible for possible faults due to the equipment operation at voltage values exceeding the inverter ratings and is not responsible for any consequential and accidental damages.

NOTE

For the warranty terms, refer to the warranty certificate provided with the product.

2.2.1. Product Nameplate

The following technical and identification data of the inverter are stamped on the product nameplate:

- Product name.
- Code assigned to the equipment by Elettronica Santerno.
- Equipment ratings (rated input/output current and voltage, etc.)
- CE symbol and other information related to the standards applicable to the manufacturing of the product (CE is a collective registered mark).
- Serial number of the equipment (see Figure 7: Serial number of a SUNWAY M PLUS).

The nameplate is silver-coloured and its dimensions are 100x70mm.

The figure below is an example of a SUNWAY M PLUS nameplate:

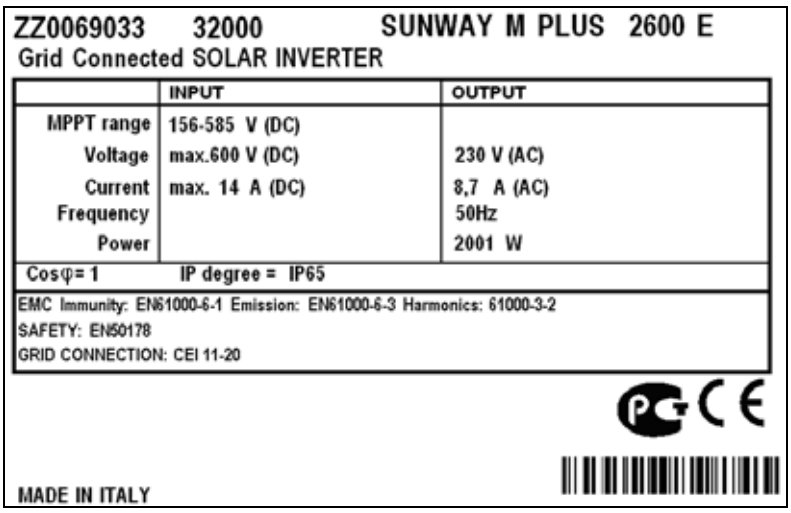

ZZ0069033 32000 SUNWAY M PLUS 2600 E
Grid Connected SOLAR INVERTER
INPUT
OUTPUT
MPPT range 156-585 V (DC)
Voltage max.600 V (DC) 230 V (AC)
Current max. 14 A (DC) 8,7 A (AC)
Frequency 50Hz
Power 2001 W
Cosφ= 1 IP degree = IP65
EMC Immunity: EN61000-6-1 Emission: EN61000-6-3 Harmonics: 61000-3-2
SAFETY: EN50178
GRID CONNECTION: CEI 11-20
MADE IN ITALY

Figure 6: Example of a SUNWAY M PLUS nameplate

2.2.2. Serial Number

The serial number can be found in the lower part of the product, next to the connectors (see 2.2.1 Product Nameplate).

Figure 7: Serial number of a SUNWAY M PLUS inverter

2.2.3. Product Code

The product name is used to identify the inverter and can be found on the nameplate among other technical information (see section 2.2.1 Product Nameplate).

The name of the product is made up of the following fields:

SUNWAY M PLUS XXX YY E

XXX	**Model**	Refer to the Solar Energy Catalogue
YY	**Geographical Configuration**	If not specified: Italy ES: Spain DE: Germany FR: France GR: Greece KR: Korea
E	**Voltage Range**	If specified: Extended MPPT range of the inverter

Examples:

SUNWAY M PLUS 2600	for the Italian market.
SUNWAY M PLUS 2600 E	for the Italian market with extended inverter MPPT range.
SUNWAY M PLUS 2600 DE	for the German market.
SUNWAY M PLUS 2600 DE E	for the German market with extended inverter MPPT range.

2.2.4. Options Plate

ZZ0069740
SUNWAY – M PLUS
OPT. POSIT. EARTHED
MADE IN ITALY

NOTE

The codes for the options purchased are provided in the delivery note.

2.3. Transport and Handling

State-of-the-art packing is provided when shipping the SUNWAY M PLUS. Handling should be done using a transpallet or a lift truck with a carrying capacity of at least 100 kg, in order not to damage the product.

Get near the installation place, then unpack following the instructions provided below (see Figure 8: Procedure for opening the package).

- Cut with pincers the plastic straps that fix the package of the SUNWAY M PLUS to the pallet.
- Cut with a cutter the adhesive tape closing the box.

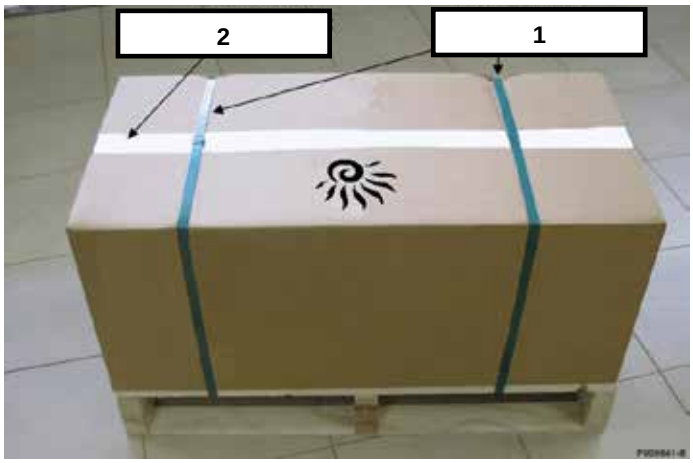


Figure 8: Procedure for opening the package

CAUTION

The whole original packing is to be kept for the full duration of the warranty period.

Based on the configuration of the product, the content of the packing may have a maximum weight of 66 kg. The centre of gravity of the SUNWAY M PLUS does not match with the geometrical centre of the packing. It is therefore recommended that the packing be handled with extreme care by at least three persons. Always use proper handling equipment.

· Remove the SUNWAY M PLUS from its packing use its side handles. To avoid damaging the packing, lift the SUNWAY keeping it horizontal to the floor.

Figure 9: Procedure for removing the SUNWAY M PLUS from the packing

· Put all the packing elements in the box and store it in a dry environment.

Figure 10: SUNWAY M PLUS box with packing elements

2.4. Installation

The SUNWAY M PLUS is to be installed on a vertical wall with suitable load-bearing capacity. A special bracket is provided for an easier assembly of the equipment.

To allow for an easy installation and a more effective ventilation of the inverter, ensure that adequate free space is left around the equipment.

CAUTION

Do not install the SUNWAY M PLUS in a position exposed to direct solar radiation.

NOTE

The installation place for the SUNWAY M PLUS is to be chosen on the basis of its protection degree. It is recommended not to install a model with an IP54 protection degree in an environment potentially subject to weather conditions or indirect water jets.

2.4.1. Environmental Requirements for Equipment Storage and Transport

Required Values	
Maximum number of packed SUNWAY M PLUS inverters that can be stacked up	3
Ambient temperature for storage and transport	-25 °C ÷ +70 °C
Ambient humidity for storage	5 % to 95 %, 1 g/m^3 to 25 g/m^3, non-condensing and non-freezing (class 1k3 as per EN50178).
Ambient humidity during transport	Max. 95 %, up to 60 g/m^3, a light condensation may appear when the equipment is not running (class 2k3 as per EN50178).
Atmospheric pressure for operation and storage	86 to 106 kPa (classes 3k3 and 1k4 as per EN50178).
Atmospheric pressure during transport	70 to 106 kPa (class 2k3 as per EN50178).

Table 2: Ambient requirements for storage and transport

CAUTION

Ambient conditions strongly affect the life of the device. Do not install the equipment in places that do not comply with the above-mentioned ambient conditions.

The SUNWAY M PLUS may produce noise when operating. Do not install the equipment in living areas and on plasterboard.

2.4.1.1. Dimensions and Weights

For the dimensions and weights of the inverter, refer to Table 86: General data.

2.4.1.2. Installation Clearances

A minimum clearance from other objects must be respected around the inverter to ensure correct heat dispersion, as specified in the following table.

Side	Min. Clearance
Lateral	120 mm
Top	200 mm
Bottom	150 mm
Front	150 mm

Table 3: Installation Clearances

NOTE

The above-mentioned clearances may be increased to ensure adequate cooling of the SUNWAY M PLUS. Moreover, it may be necessary to provide sufficient circulation of fresh air.

2.4.2. Components Supplied

The basic configuration of the SUNWAY M PLUS inverter includes the components shown below.

S000232

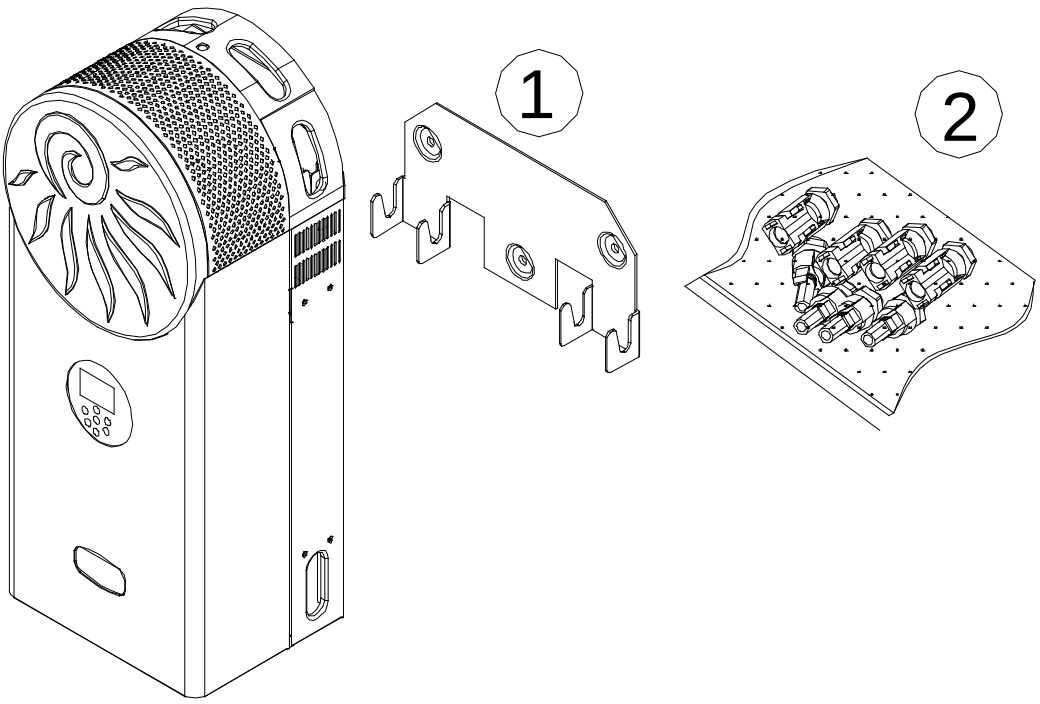


Figure 11: Components supplied with the product

Ref.	Q.ty	Description
1	1	Wall mounting bracket
2	1	Kit of quick-coupling PV connectors, MC4 type
2	4	Plugs for unused male connectors
2	4	Plugs for unused female connectors

Table 4: Components supplied with the product

2.5. Wall Installation

CAUTION

Install in upright position or tilted backwards of max. 15°.

Do no install tilted forwards.

Do not install in horizontal position.

Install at eyes level, to allow for rapid access and consultation of the operating data shown on the display/keypad.

For proper installation of the SUNWAY M PLUS, follow the instructions below:

- Fasten the bracket and equipment to the wall as shown in the figure. Use 5 wall anchors with 6 mm screws: 3 anchors to fasten the bracket (A) and 2 anchors to fasten the equipment (B) after fitting it onto the bracket (anchors are not supplied since the type of anchors to be used depends on the wall chosen for installation).

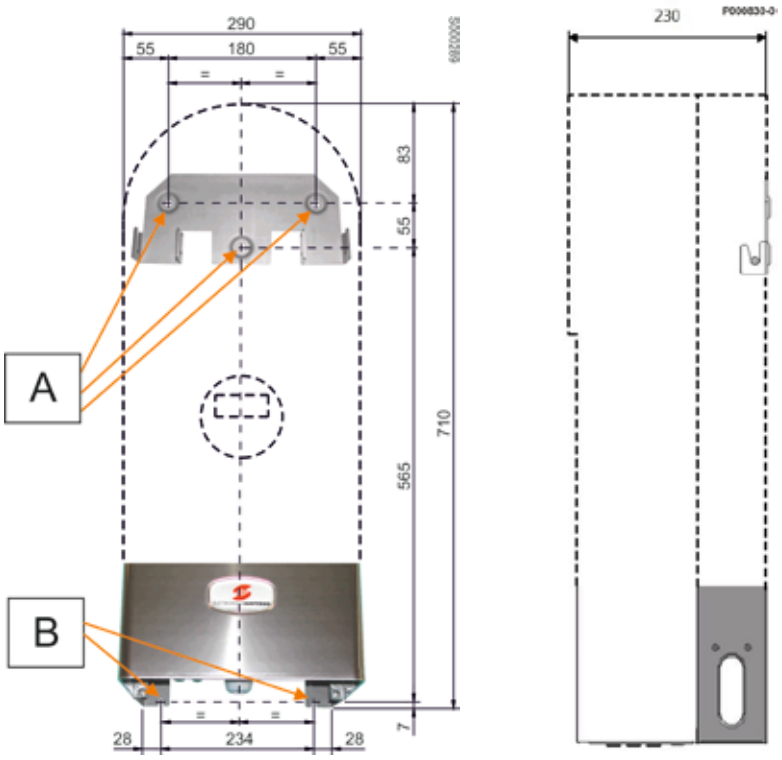


Figure 12: Detailed view of the SUNWAY M PLUS mounting bracket and fastening screws

CAUTION

When handling the equipment, consider that its weight ranges from 39 kg to 66 kg depending on the product version (refer to Table 86: General data).

Figure 13: Procedure for handling the SUNWAY M PLUS inverter

· Fit the SUNWAY M PLUS onto the bracket (C). When lifting the equipment, use its side handles. Iron pins may also be inserted through the two upper handles for lifting. Moreover, it is possible to fit an eyebolt – not supplied – into the M12 threaded hole on top of the SUNWAY M PLUS.

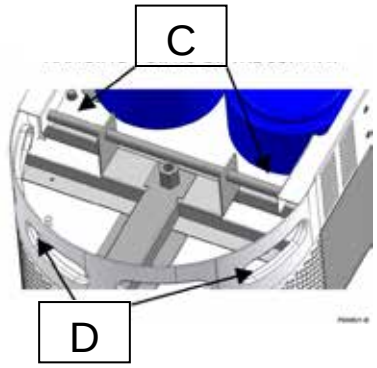


Figure 14: Detailed view of the handles

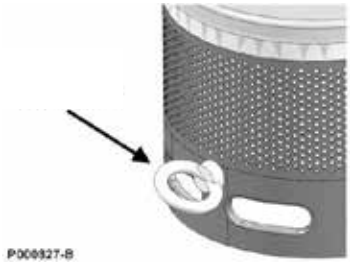


Figure 15: Detailed view of eyebolt location

CAUTION

If the inverter is equipped with the Auxiliary Power Supply Unit, it is not possible to insert an iron pin through the top handles.

To avoid damaging the SUNWAY M PLUS mechanical components and connections, do not lay it in upright position on the ground.

- Install the screws in the anchors located in the lower part of the SUNWAY M PLUS.
- Ensure that the SUNWAY M PLUS is securely fastened to the wall.

CAUTION

The cover of the SUNWAY M PLUS is provided with a protective film. Remove the film before starting the equipment.

NOTE

The installation place for the SUNWAY M PLUS is to be chosen on the basis of its protection degree. It is recommended not to install a model with an IP54 protection degree in an environment potentially subject to weather conditions or indirect water jets.

2.6. Electrical Connections

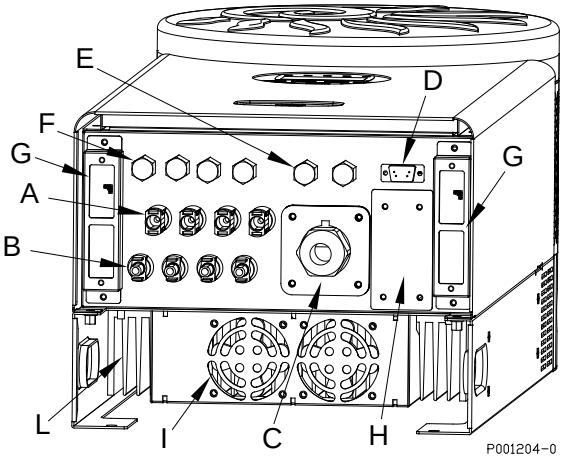


Figure 16: SUNWAY M PLUS IP54 connections

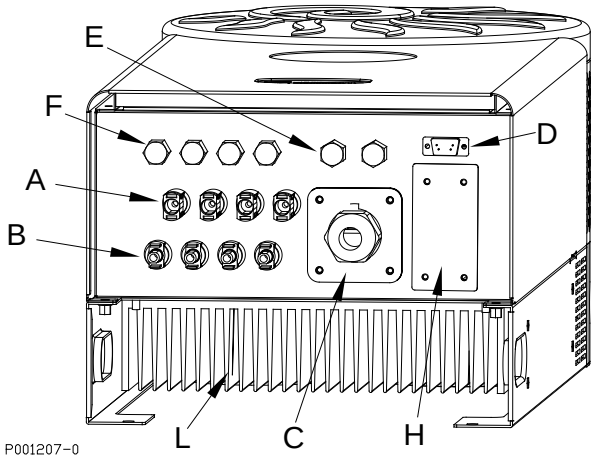


Figure 17: SUNWAY M PLUS IP65 connections

Description of the Mechanical Components and Connections	
A	PV field input, positive pole
B	PV field input, negative pole
C	Connection to the grid
D	RS485 connection
E	Fittings for ambient signals
F	Fittings for secondary PV field input
G	Cooling vents on IP54 models
H	Data Logger slot
I	Cooling grids
L	Heat sink

Table 5: Description of the SUNWAY M PLUS mechanical components and connections

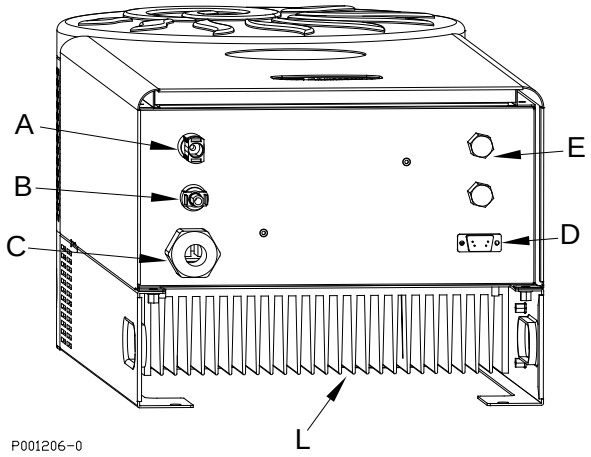


Figure 18: SUNWAY M PLUS 1300E mechanical components and connections

SUNWAY M PLUS 1300E Mechanical Components and Connections	
A	PV field input, positive pole
B	PV field input, negative pole
C	Connection to the grid
D	Communication port
E	Fittings for ambient signals
L	Heat sink

Table 6: SUNWAY M PLUS mechanical components and connections, one string

The electrical connections described above refer to a configuration where a single PV field is connected to the SUNWAY M PLUS. If the Additional PV Field option is fitted, refer to section 4.2 Additional Photovoltaic Field (PV2) for the specifications on its electrical connection. If multiple inverters are connected to the same point of delivery to the grid, refer to section 3.3 Multi-inverter Connection.

2.6.1. Connection to the User's Grid (AC)

To connect the SUNWAY M PLUS to the user's grid, use the cable assembly available inside the inverter.

DANGER

Ensure there is no voltage before performing any operations on the grid.

CAUTION

Do not connect grid voltages exceeding the single-phase rated voltage (230V ±15%) to avoid damaging the internal circuits.

Always install an MCCB circuit breaker to protect the electric circuit.

DANGER

Always connect to safety grounding.

The connection diagram prescribes the installation of an MCCB circuit breaker between the user's grid and the SUNWAY M PLUS.

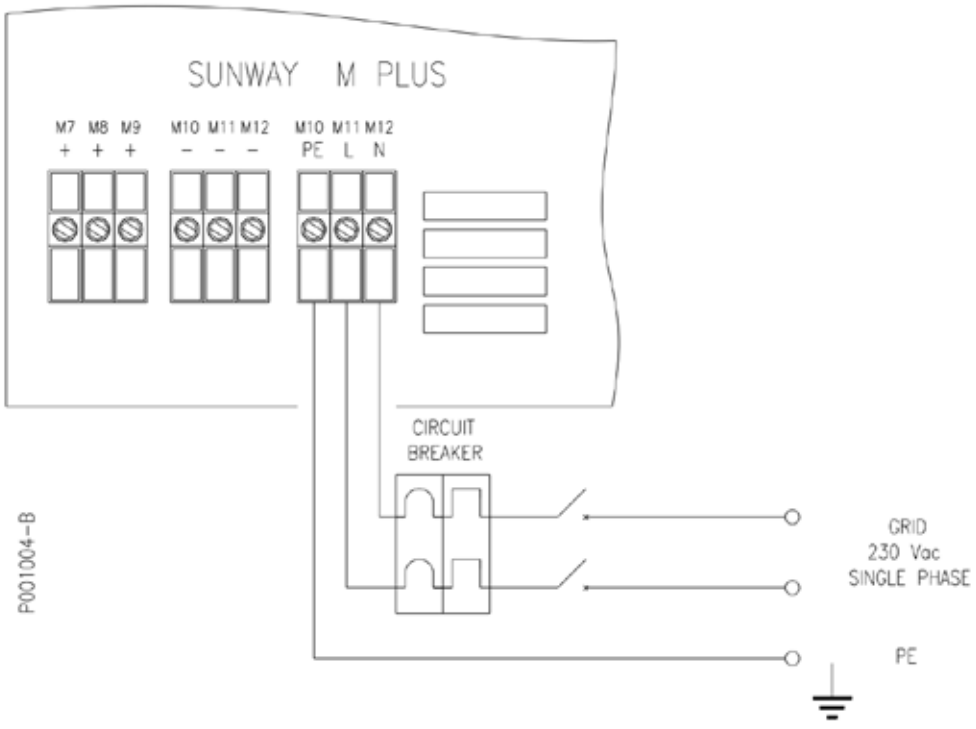


Figure 19: AC cable connection

1. Install the circuit breaker, making sure that no electric load is interposed between the circuit breaker and the SUNWAY M PLUS. Make sure that the current capacity of the electrical installation in that point is adequate for the connection.

NOTE

No Residual Current Device is required to protect the SUNWAY M PLUS, since the inverter is galvanically isolated from the grid through a transformer.

Make sure that the wiring diagram complies with the standards applicable to the installation site.

2. Connect the SUNWAY M PLUS to the grid using the cable assembly provided. If required, it is possible to remove the cable assembly provided and replace it with the selected one, as shown in the picture below. When doing so, use the special cable gland and tighten it properly.

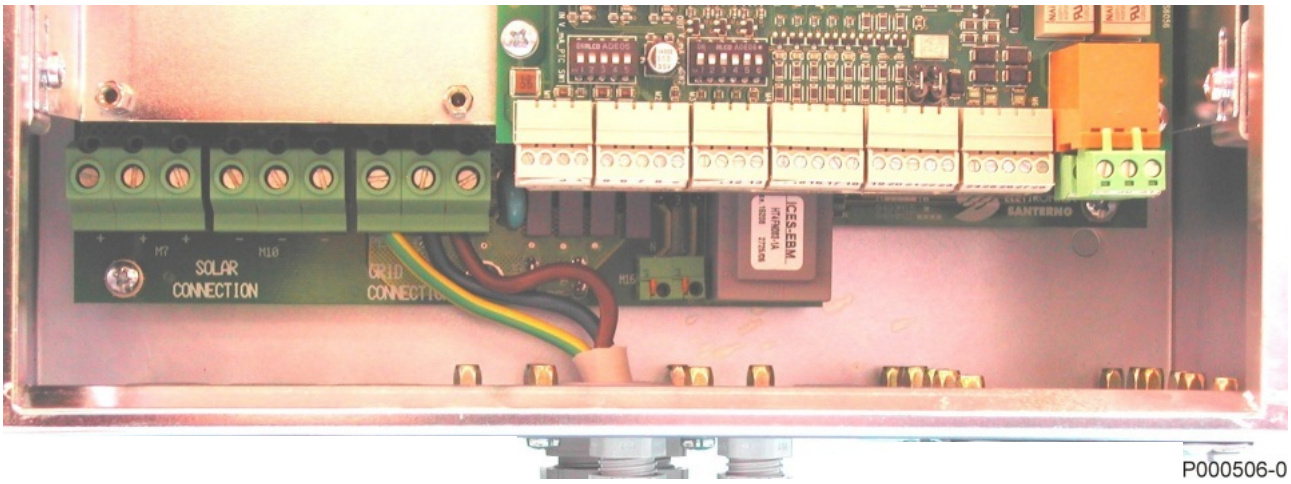


Figure 20: Internal AC cable connection

3. Once the electrical connection to the grid has been carried out, keep the circuit breaker open.

CAUTION

In countries following the grid connection standard VDE 126-1-1 and on the inverters with SW version earlier than 1.67, it is necessary to provide for the installation of an Automatic Disconnection Device, ENS26, between the inverter and the grid.

For details, refer to the Installation Manual of the automatic grid disconnection device ENS26 UFE.

2.6.2. Grid-connection Contactor

The AC grid-connection contactor, located inside the inverter, allows for the connection of the SUNWAY M PLUS to the Public Distribution Grid.

If the safety interface trips or in case of an alarm, the grid-connection contactor opens, thus causing the disconnection from the grid and the inverter to stop. The grid-connection contactor is a device able to operate under load and its rating is adequate to the max output current of the inverter.

The grid-connection contactor may implement the function of Interface Protection Device, according to the type of installation and to the applicable prescriptions and standards for connection.

The status of the grid-connection contactor can be monitored by means of the RUN LED on the display/keypad.

RUN LED Status	Description
LED ON	Contactor closed, inverter is connected to the grid.
LED OFF	Contactor open, inverter is NOT connected to the grid.
START	Activates connection to the LV grid and energy production (if conditions are OK).
STOP	Disconnects the contactor from the LV grid and sets the inverter to Stand-by mode. Disables the operation in parallel to the LV grid in the SUNWAY M PLUS.

Table 7: Grid-connection contactor

2.6.3. Connection of the PV Field Cables (DC)

Each string is composed of a given number of series-connected PV modules. The PV generator may consist of a single or multiple parallel-connected strings. The configuration of the Main PV Field should be defined depending on the voltage range allowed by the SUNWAY M PLUS (see section 7 TECHNICAL SPECIFICATIONS) and on the power that is to be installed.

Up to four strings may be connected in parallel to the SUNWAY M PLUS, with no need to install any additional component. Quick-coupling PV connectors (MC4 type) are used for the connection of the PV field.

DANGER

Make sure that the MCCB circuit breaker is open and the grounding (PE) conductor is connected.

CAUTION

Do not connect any photovoltaic generator capable of producing a field voltage exceeding the maximum allowable rating (600V). If a voltage exceeding the max allowable rating is applied to the inverter, failures may occur on the internal circuits.

DANGER

The voltage produced by the photovoltaic generator radiated by sunlight (even weak sunlight) can reach 600V.

If the PV field requires the polarization of the positive or negative pole by means of connection with the earth conductor, any contact with the other pole entails the risk of death. Cable stripping and wiring must be carried out with extreme care using proper tools. Always take EXTREME CARE to avoid any unintentional contacts with the free pole from the PV generator. Contact with both polarities leads to severe injury or death due to electric shock.

CAUTION

The max rated voltage of the PV field must never be exceeded. A higher voltage will damage the equipment in an irreversible manner.

The specifications for the PV field and the dimensioning recommended for the connection cables are given in Table 85: Input/output electrical specifications.

NOTE

The peak power of the PV generator should not exceed the value shown in the table. Exceeding values do not entail malfunctions to the inverter, as the equipment automatically limits the power fed into the grid. However, in this way the PV generator is not exploited at its best.

The voltage at the maximum power point of the PV generator, under the intended conditions of operation (min/max radiation, min/max temperature of the modules) must be within the MPP Field Voltage Range.

Perform the following operations:

- Check voltage and polarity of each string.
- Compare the field voltage with the allowed voltage range.
- Connect the strings of the Main PV Field to the quick-coupling MC4 PV connectors, ensuring that the correct polarities are respected as per Figure 21: Connection polarities for the strings of the Main PV Field.

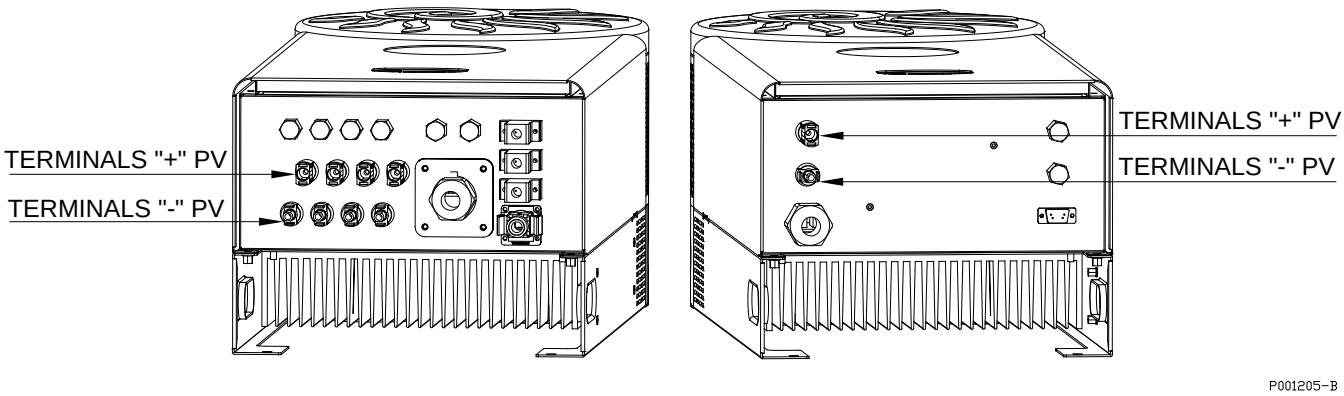


Figure 21: Connection polarities for the strings of the Main PV Field

CAUTION

If sunlight hits the PV generator and no disconnecting switches are installed downstream of the PV generator, connecting the PV field causes the equipment and the display to be powered on. Avoid touching any part of the electronic boards.

Plug any unused cable glands and quick-coupling connectors of the inverter to maintain the IP rating of the equipment.

2.6.4. Technical Specifications of the Quick-coupling MC4 PV Connectors

The inverter inputs are compatible unipolar conductors having a 4 mm^2 to 6 mm^2 section and an external diameter between 3 and 6 mm. The procedure for the connection/disconnection of the strings is described below.

- String connection: Plug in the contacts until it locks. Try to pull out the connectors to make sure that they are correctly locked.

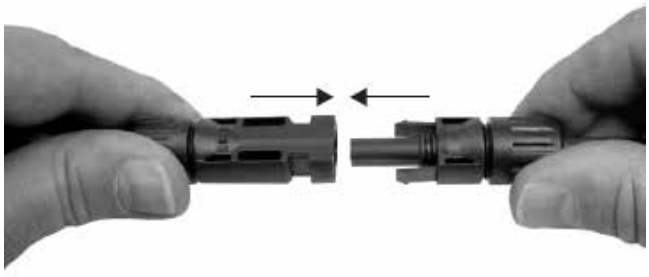


Figure 22: Coupling procedure for string connection.

- String disconnection: Press on the two side tabs until it releases, and then separate the contacts.

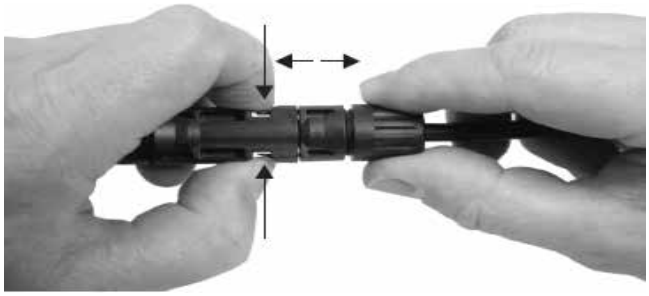


Figure 23: Uncoupling procedure for string disconnection.

The cable section must be within the range allowed by the connectors, otherwise it will not be possible to insert the cable in the connector (refer to Table 84: Specifications for input/output cables).

2.7. Display/Keypad Module

The display/keypad module represents the human-machine interface (HMI) of the equipment, and is installed on the front part. The display/keypad module allows performing the following operations:

- Sending the machine START and STOP commands and the alarm RESET command.
- Programming the machine parameters (refer to section 5 PROGRAMMING).
- Displaying values and messages related to the operating conditions of the inverter (refer to section 5 PROGRAMMING).

2.7.1. Keys of the Display/Keypad Module

The display/keypad module features 5 LEDs, a liquid-crystal display with four rows of 16 characters, a buzzer and eight keys. The display allows reading the parameter values, diagnostic messages and the measures computed by the inverter.

For all the details on the menu structure, parameter setting, measure selection and display messages refer to section 5 PROGRAMMING.

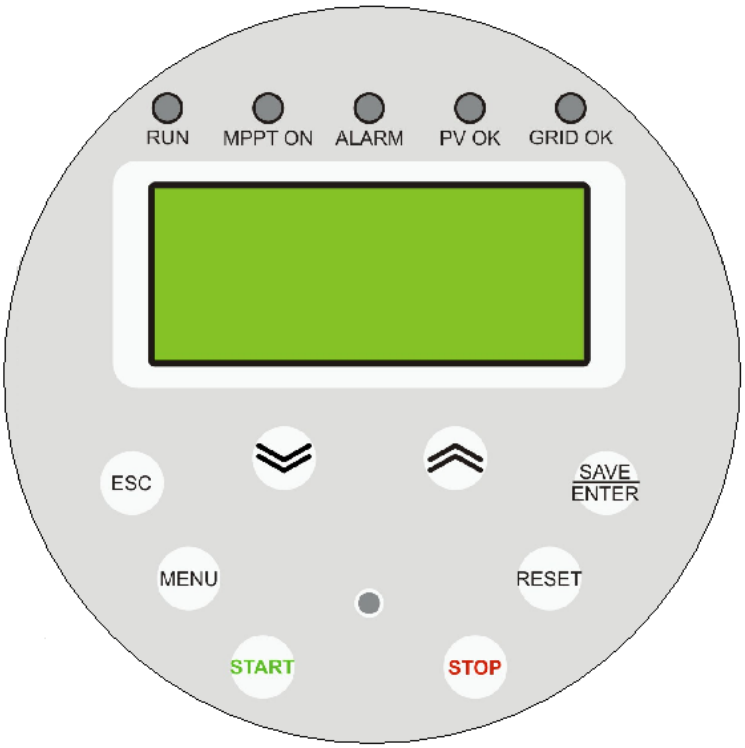


Figure 24: Display/keypad module

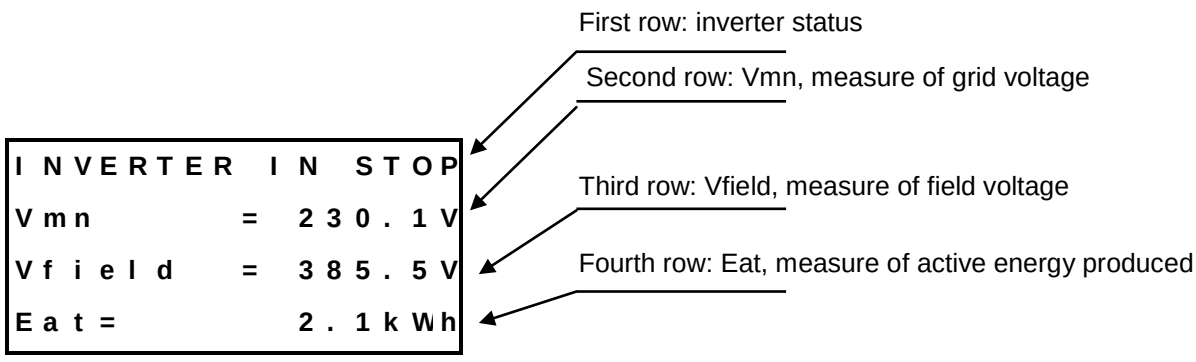
Key	Function
ESC	DURING PAGE SELECTION – Allows quitting a menu or submenu (parent menu is displayed)
	DURING PROGRAMMING – In the programming mode (flashing cursor) it terminates a parameter modification and allows selecting other parameters (the switching from the parameter programming mode to simple display mode is signalled by the cursor stopping flashing). The value of the modified parameter is NOT saved to the non-volatile memory, and therefore is lost upon the next equipment powering off.
	DURING PAGE SELECTION – Allows scrolling down through menus and submenus, pages in a submenu, or parameters.
	DURING PROGRAMMING – Allows decreasing the parameter value being edited.
	DURING PAGE SELECTION - Allows scrolling up through menus and submenus, pages in a submenu, or parameters.
	DURING PROGRAMMING – Allows increasing the parameter value being edited.
SAVE/ENTER	DURING PAGE SELECTION – Allows accessing the menus and submenus and activates the parameter programming mode (the switching from the display mode to parameter programming mode is signalled by the cursor starting flashing).
	DURING PROGRAMMING – Allows storing the new parameter value to the non-volatile memory, to avoid the changes being lost upon next power off of the equipment.
MENU	DURING PAGE SELECTION – When pressed more than once, it allows scrolling through the status pages.
RESET	Allows resetting an alarm once the condition that fired it has disappeared.
START	Allows starting the equipment. The START command is automatically stored, i.e., if the equipment turns off without having received a STOP command, upon next power on the START status will be still active, so that as soon solar radiation is sufficient the inverter will connect in parallel to the grid and start feeding power into it.
STOP	Allows stopping the equipment. The STOP command is automatically stored, i.e., if the equipment turns off, upon next power on the STOP status will be still active, so that the START key is to be pressed to resume operation.

Table 8: Functions of the keys on the display/keypad module

LED	Function
RUN	● Inverter in STOP or in STAND-BY mode Grid-connection contactor open
	● Inverter operating Grid-connection contactor open
MPPT ON	● MPPT disabled
	● MPPT enabled
ALARM	● Inverter OK
	● Inverter in ALARM
PV OK	● PV field voltage out of range low or high
	● PV field voltage is correct
GRID OK	● Incorrect grid parameters **NOTE:** this LED is always off during the night and when the PV field is not correctly connected
	● Grid parameters are correct

Table 9: Functions of the display/keypad module LEDs

The alphanumeric display consists of the following elements:


First row: inverter status
Second row: Vmn, measure of grid voltage
Third row: Vfield, measure of field voltage
Fourth row: Eat, measure of active energy produced
INVERTER IN STOP
Vmn = 230.1V
Vfield = 385.5V
Eat = 2.1kWh

The alphanumeric display features a 'smart backlighting' system, which activates only when a key is pressed. If no key is pressed again within approx. 1 minute, backlighting will turn off.

2.7.2. Adjustment of the Contrast Only

Press the SAVE key for more than 5 seconds; *** TUNING *** is displayed; the LEDs located above the display turn on and configure as a 5-dot bar extending proportionally to the contrast value being set. Press ⩔ or ⩓ to adjust the display contrast. Press SAVE for at least 2 seconds; the display returns to normal mode using the new contrast setting.

NOTE

If alarm A081 (display/keypad watchdog) trips after adjusting the display contrast, this is not due to any fault to the display/keypad; just reset the alarm by pressing the RESET key on the display/keypad module.

2.7.3. Adjustment of Contrast, Backlighting and Buzzer

Press the TX | RX + SAVE keys for more than 5 seconds; the display enters in the full programming mode. Use the ⩔ and ⩓ keys to scroll through the seven parameters available for the display/keypad module. When the parameter is displayed, it is possible to edit it by pressing the PROG key and then using the ⩔ and ⩓ keys. After selecting the desired value, press SAVE to store the new parameter setting in the non-volatile memory of the display/keypad module.

The following table provides the values applicable to each parameter and their meaning.

Parameter	Possible Values	Description
SW Ver.	-	Version of the internal software of the display/keypad module (not editable)
Language	Not used in this application	
Contrast	**LOC**	Contrast is set locally on the display
	REM	Contrast is set by the inverter and commanded to the display
Contrast val.	**nnn**	Numerical value of the contrast setting, from 0 (low) to 255 (high)
Buzzer	**KEY**	Buzzer activates upon key pressure
	REM	Buzzer is controlled by the inverter
	OFF	Buzzer is set permanently to off
Backlighting	**ON**	LCD backlighting is always on
	REM	LCD backlighting is activated upon an inverter's command
	OFF	LCD backlighting is always off
Address	Not used in this application	

Table 10: Display/keypad adjustment parameters

After setting the parameters at the desired values, press the SAVE key for more than 2 seconds to return to normal operation.

2.8. Commissioning

This section described the preliminary checks and the basic procedures to be followed when commissioning the equipment.

2.8.1. Preliminary Checks

CAUTION

Before carrying out the interconnections of the SUNWAY M PLUS to the grid and the PV field, check that all the power connections as well as the signal and auxiliary lines are securely connected.

Checks to be performed:

- Check the correct positioning on the wall mounting support bracket.
- Check that the interconnections of the SUNWAY M PLUS to the grid and the PV field are correct.
- Check the covers and safety panels. If they have been removed, reinstall them.
- Check that unused cable glands and quick-coupling PV connectors are correctly plugged.

Inverter powering on:

- Close the AC switch. After a few seconds the GRID LED on the display turns on.
- Close the disconnection devices on the PV generator side, if any.
- The equipment is now ready to feed active power into the grid, power factor=1, with the automatic Maximum Power Point Tracking function (MPPT).

If the PV field voltage is higher than the power-on threshold (see Table 85: Input/output electrical specifications) the inverter will appear as powered with the display showing a message similar to the following:

INVERTER IN STOP
Vmn = 230.1 V
Vfield = 385.5 V
Eat = 0.0 kWh

- Press the START key on the display/keypad module.

At this point, if the voltage from the PV generator [Vdc] is higher than the threshold preset on parameter P020 (see section 5 PROGRAMMING) the inverter provides for the synchronization with the public grid, closes the grid-connection contactor and starts feeding power into the grid.
The inverter status is signalled by the LEDs and display located on the front of the inverter.

NOTE

The START command sent by pressing the key will be stored. Therefore, if the equipment turns off without an alarm being tripped or without the STOP key being pressed, upon next powering on the START status will still be active.

· To reset any active alarms, press RESET on the display/keypad module. If the cause that fired them no longer exists, the alarms will be reset and it will be necessary to send the START command again.

NOTE

The automatic reset of the alarms (see ALARM AUTORESET MENU C033 ÷ C046) does not cause the termination of the START status. Therefore, as soon as the condition that activated the alarm no longer exists, the alarm is automatically reset and the inverter will resume operation without the need to send the START command again.

CAUTION

When an alarm message is displayed, always inspect its cause before restarting the equipment.

DANGER

Wait at least 10 minutes after powering off the inverter before performing any operation on the electrical connections, thus allowing the capacitors on the intermediate circuit to discharge.

Once started, the SUNWAY M PLUS operates in full automatic mode. If solar radiation is absent, the equipment completely turns off (as a consequence the display turns off too), thus avoiding even negligible self-consumption. When solar radiation is present, the SUNWAY M PLUS automatically restarts and resumes the production of electric power.
The SUNWAY M PLUS inverter is factory-set with a set of parameters fitting most applications; therefore, no parameter modification is required generally. Parameter programming changes are required only for particular circumstances or to enable optional functions.

2.8.2. Basic Programming

When the inverter is delivered, its operating parameters are already set up and no parameter modification is generally required. However, to ensure the highest performance of the inverter, it is recommended to set the parameter P029 according to the type of panels installed.

If the MPPT function is enabled, parameter **P029** specifies the initial value for the max power point tracking with respect to the open-circuit field voltage.

Ex. if Voc= 450 V and P029 = 90 %, when the START command is sent, the MPPT starts from 405V.

This parameter can be enhanced based on the type of panels installed and by calculating the Vmp/Voc ratio, where Vmp is the rated voltage of the panel and Voc is the open-circuit voltage.

Proceed as follows:

1. Press the MENU key. The display show the following page:

I	N	V	E	R	T	E	R		I	N		S	T	O	P
V	m	n					=			2	3	1	.	0	V
V	f	i	e	l	d		=			3	5	6	.	4	V
[	M	E	A	]	P	A	R		C	F		I	D	P	

2. Move the cursor using the arrow ^ to the PAR menu.

I	N	V	E	R	T	E	R		I	N		S	T	O	P
V	m	n					=			2	3	1	.	0	V
V	f	i	e	l	D		=			3	5	6	.	4	V
	M	E	A		[P	A	R	]	C	F		I	D	P	

3. Access the PAR menu by pressing SAVE/ENTER.

4. Press the arrow ^ until the display shows the FIELD menu.

[P	A	R	]			P	0	2	0	-	P	0	3	0	
					F	I	E	L	D						

5. Access the FIELD menu by pressing SAVE/ENTER.

6. Press the arrow ^ until the display shows the parameter P029.

P	0	2	9												
M	o	d	u	l	e		V	m	p	/	V	o	c		
R	a	t	i	o											
						=		9	0	%					

7. Press SAVE/ENTER to modify the parameter value, which is set by default to 90% (the cursor starts flashing). Set the new value, as determined based on the rated values of the panels.

8. Press SAVE/ENTER to store the new parameter value (the cursor stops flashing). The display will permanently show the new setting.

9. Press MENU until the initial screen is displayed.

I	N	V	E	R	T	E	R		I	N		S	T	O	P
V	m	n					=			2	3	1	.	0	V
V	f	i	e	l	d		=			3	5	6	.	4	V
[	M	E	A	]	P	A	R		C	F		I	D	P	

2.8.3. Status Messages

The operating statuses of the inverter are described in the following table.

Condition	Condition	Status	Display Message
STOP	The inverter has been disabled by the user	The ENABLE command is not provided in the control terminals (the inverter factory-setting provides the ENABLE command)	Stop Waiting Ena.
		This is the first starting; the START key has not been pressed.	Inverter in STOP
		The STOP key has been pressed. Press the START key to restart the equipment.	Inverter in STOP
STAND BY	The inverter is disabled and is waiting for suitable conditions of the PV field and/or the grid to start	Weak field voltage. The starting voltage for the equipment is specified in Table 85: Input/output electrical specifications. Parameter P020 allows changing the starting voltage.	Stand by VFKO
		The field voltage is higher than the starting value. The inverter is checking that the voltage produced by the PV field is higher than the starting voltage for at least 60s before checking the grid voltage. Countdown is displayed by the timer. This timeout may be modified through parameter P021.	S-BY VFKO xxx.xs
		The field voltage is OK and has been kept steady for the min. time. The inverter is checking that the grid is being kept steady for at least 5s. Countdown is displayed by the timer.	S-BY Vgrid xxx.xs
		Inverter in STOP. The inverter is waiting for a timeout since too many start attempts have failed (factory setting: C002-10 attempts, C003-1800s timeout).	S-BY St.KOxxx.xs
		The grid voltage is lower than the minimum allowable value.	S-BY Vrmin KO
		The grid voltage exceeds the maximum allowable value.	S-BY VrMax KO
		The grid frequency is out of range.	S-BYGridKOFRgrid

Condition	Condition	Status	Display Message
STAND BY	The inverter is disabled and is waiting for suitable conditions of the PV field and/or the grid to start	No synchronisation with the grid.	S_BY PLL KO
		Inverter in STOP because the external interface protection relay is detecting a grid fault. **Important:** Normally, this condition does not occur, because no external relay is required for standard installation.	SBYGridKORelays
		Timeout in progress (C004: 300s as per factory setting) after restoring the OK status of the connection to the LV grid. Countdown progress is displayed by the timer.	S-BY Relays xxx.xs
STARTING	The inverter is connecting in parallel to the grid	The inverter has started. The inverter is performing the transformer fluxing and is synchronising with the grid before closing the parallel contactor.	SYNCHRO
OPERATION	The inverter is delivering power to the grid	The inverter is delivering power to the grid.	Run P=##.#kW
POWER OFF	Inverter in stop	The STOP button has been pressed. Power delivered to the grid is gradually dropping to zero; then the inverter stops and opens the parallel contactor.	POWER OFF
ALARM	Inverter locked	An alarm condition has occurred; the inverter is in STOP status.	Alarm A###
ALARM RESET	An alarm is being reset	The RESET button has been pressed or the inverter is performing the Autoreset procedure. The cause responsible for the alarm has disappeared and ordinary operation is being restored.	Resetting
COOLING	Inverter locked	Inverter overheated; the countdown for the inverter cooling set in parameter C043 (which is factory-set to 900s) is in progress.	ST-BY OL = xxx.xs

Table 11: Inverter operating statuses.

2.9. List of the Alarms and Warnings

CAUTION

When a protection or an alarm trips, the inverter operation is disabled.

The possible alarms are detailed in the following sections.

NOTE

Carefully read the following paragraphs before intervening on the inverter commands.

2.9.1. What Happens when a Protection Trips

When a protection/alarm trips, the **ALARM LED** located on the display/keypad comes on, and the reference code for the alarm is displayed (see 5.2.9 FAULT LIST MENU)

Factory setting: when an alarm trips, this is not cleared when the inverter is next powered on.

Therefore, if an alarm trips at power on, this could be due to an unreset alarm that tripped before the inverter was powered off.

To avoid storing the alarms tripped before a powering off of the inverter, set parameter **C035** accordingly in the ALARM AUTORESET MENU C033 ÷ C046.

When an alarm trips, the inverter stores to the **FAULT LIST** its trip times (supply time and operation time), the inverter status and the value of a set of measures sampled when the alarm tripped.

Recording and reading this data can be very useful to find out the cause that fired the alarm and to remove the alarm condition.

NOTE

In case of activation of an alarm whose index is lower than A40, a malfunction may have occurred to the control board. Contact the Elettronica Santerno SpA's AFTER-SALES SERVICE.

2.9.2. What to Do when an Alarm Trips

Procedure to follow:

From the **FAULT LIST**, note down the data related to the alarm tripped, in order to identify the cause responsible for the alarm and to find possible solutions.

Data from the fault list are also required if you need to contact Elettronica Santerno's AFTER-SALES SERVICE.

1. The following pages provide a description of the alarms. Look for the section related to the alarm code you noted down and follow the instructions provided.
2. Remove the external causes that activated the alarm.
3. If an alarm tripped due to wrong parameter values, set the correct values and save the parameter setting.
4. Reset the alarm.
5. If the alarm condition persists and no solution can be found, please contact Elettronica Santerno's AFTER-SALES SERVICE.

A **RESET** command is required to reset an alarm tripped: press the **RESET** key on the display/keypad module.

An automatic **RESET** function is also available, which requires setting the autoreset attempts at a number other than zero (parameter **C033**). In this case, the inverter will try to automatically reset the alarms tripped (except for those alarms not allowed for automatic reset; refer to 5.4.3 ALARM AUTORESET MENU C033 ÷ C046).

2.9.3. List of the Alarms A001 ÷ A135

Alarm	Name	Description
A001 ÷ A032	CTRL KO	Control board failure.
A033, A039	TEXAS VER KO	Incompatible Texas Software version.
A043	FALSE INTERRUPT SOFTWARE	Control board failure.
A044	SW OVERCURRENT	Software overcurrent.
A048	OVERVOLTAGE	DC-bus voltage exceeding Vdc_max.
A049	RAM CHECK KO	Control board failure.
A051	HW A OVERCURRENT	Hardware overcurrent, side A.
A053	IGBT FAULT PWONA	Hardware failure, impossible to power IGBT A.
A061	SERIAL n.0 WDG	Watchdog tripped in serial link 0.
A063	GENERIC MOTOROLA	Control board failure.
A067	CONTROL B. OVERHEATED	Control board temperature exceeding 75 °C
A071	1 ms INTERRUPT OVERTIME	Control board failure.
A074	OVERLOAD	The inverter has been delivering a current level exceeding the rated current for too long.
A075	GRID OVERVOLTAGE	The inverter has detected a dangerous voltage level on the grid.
A078	MMI KO	Control board failure.
A081	WATCHDOG	Display/keypad failure.
A084	SENSOR 2 FAULT	Failure of NTC temperature sensor on heatsink
A087	+/- 15V FAILURE	Control board failure.
A088	ADC NOT TUNED	Control board failure.
A092	MOTOROLA SOFTWARE VERSION	Control board failure.
A094	HEATSINK OVERTEMPERATURE	IGBT heatsink temperature out of range high.
A113-A122	HW BOARDS KO	Control board failure.
A130 ÷ A135	ADC CH. 1 ÷ 6 ACQUISITION ERROR	Control board failure.

Table 12: List of the Alarms A001 ÷ A135

A001 ÷ A032 CONTROL BOARD FAILURE

A001 ÷ A032	Description	Failure of the control board.
CTRL KO	Event	Multiple causes are possible: the autodiagnostics function of the control board constantly checks its correct operation.
	Possible Causes	Strong electromagnetic conducted disturbance or radiated disturbance. Possible failure of the microcontroller or other circuits in the control board.
	Solutions	Reset the alarm: send a **RESET** command. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A033 Texas Software Version KO

A033, A039	Description	Incompatible Texas software version.
TEXAS VERS KO	Event	At power on, the Motorola DSP has detected that the software version downloaded to the Texas Flash is incompatible.
	Possible Causes	A wrong software version has been downloaded.
	Solutions	Download the correct software version. Contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A044 Software Overcurrent

A044	Description	Software overcurrent.
Software Overcurrent	Event	Tripping of instant current limiter.
	Possible Causes	Abrupt grid variations. Output short-circuit or short-circuit to ground.
	Solutions	Check cable tightening and wiring. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A048 Overvoltage

A048	Description	DC bus voltage (intermediate DC link) has reached a too high value.
Overvoltage	Event	Voltage measured in the DC bus (intermediate DC link) heatsink exceeds the max allowable threshold for this inverter class.
	Possible Causes	The photovoltaic generator is incompatible with the input voltage range of the SUNWAY M PLUS. Failure of the DC-bus voltage measuring circuit. Inverter failure.
	Solutions	Check the value of the DC-bus voltage measured (**M000)**. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A051 HW Overcurrent A

A051	Description	Hardware overcurrent, side A
Hardware Overcurrent	Event	The circuit measuring the inverter output current has detected a hardware overcurrent event.
	Possible Causes	Abrupt grid variations. Output short-circuit or short-circuit to ground. Strong electromagnetic conducted disturbance or radiated disturbance.
	Solutions	Check that the inverter is properly dimensioned with respect to the power of the Main PV Field. Make sure that there are no short-circuits between two phases or between one phase and the ground at the inverter output. Send a **RESET** command to reset the alarm. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A053 Not PWONA

A053	Description	Hardware failure. Impossible to power on IGBT A.
NOT PWONA	Event	The Motorola Microcontroller prompted the IGBT to power on, but the request was unsuccessful.
	Possible Causes	Control board failure.
	Solutions	Send a **RESET** command to reset the alarm. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A061 Serial Link Watchdog

A061 (Serial Link 0)	Description	A061: Watchdog in Serial Link 0 tripped	Factory settings for Watchdog: disabled
Watchdog in Serial Link no.0	Event	The communications watchdog of the serial link has tripped. Communication is cut-off: no read/write queries were sent to the serial link for a time longer than the time set for the serial link watchdog time (see 3.2 Serial Communications).	
	Possible Causes	Disconnection from the serial link. Communication cut-offs caused by the remote Master. Too short watchdog times.	
	Solutions	Check the serial link. Make sure that the remote Master ensures a continuous sequence of write/read queries with max intervals between two queries lower than the preset watchdog time. Increase the serial link watchdog times (see **R005** for serial link 0).	

A067 Control Board Overheated

A067	Description	Control board temperature exceeding the max allowable temperature.
Control Board Overheated	Event	Temperature value measured on the control board is higher than the max allowable temperature.
	Possible Causes	The environment where the inverter is installed is subject to excessively high temperatures.
	Solutions	Send a **RESET** command to reset the alarm. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A068 PV Isolation KO

A068	Description	Isolation fault of the PV field.
PV Isolation KO	Event	The relay installed at the PV field has detected an isolation loss.
	Possible Causes	There is an isolation loss between the PV field and the ground.
	Solutions	Check the galvanic isolation of the PV field. Parameters M018 and M019 allow displaying the isolation resistance between the PV field and the ground as detected by the inverter; parameter P121 allows displaying the minimum value of isolation resistance which causes the alarm to trip. Send a **RESET** command to reset the alarm. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A074 Overload

A074	Description	Current overload
Overload	Event	The output current has exceeded the max continuous output current for an exceedingly long time.
	Possible Causes	The output current has reached the max continuous rating **+50 %** for **100 ms** The output current has reached the max continuous rating **+30 %** for **3 seconds** The output current has reached the max continuous rating **+10 %** for **120 seconds**
	Solutions	Check output current delivered under ordinary operating conditions (**MEASURES MENU**).

A075 Grid Overvoltage

A075	Description	Overvoltage detected on the distribution grid.
Grid Overvoltage	Event	The grid voltage value detected is exceeding the allowed range.
	Possible Causes	A device on the grid has caused the voltage to exceed the allowance range related to the Vn rated value.
	Solutions	Send a **RESET** command to reset the alarm. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A081 Display/Keypad Watchdog

A081	Description	Display/keypad failure.
Display/Keypad Watchdog	Event	Communication with the display/keypad is cut-off.
	Possible Causes	· Display/keypad cable disconnected. · Failure at one of the two connectors of the display/keypad. · Display/keypad failure.
	Solutions	Check the connection of the display/keypad cable. Make sure that the contacts of the display/keypad cable connectors are OK (both on the inverter side and the display/keypad side).

A084 Failure of the Second Sensor

A084	**Description**	Fault of the NTC sensor detecting the heatsink temperature.
Sensor 2 Fault	**Event**	Sensor fault or disconnection.
	Possible Causes	Faulty component or strong vibrations.
	Solutions	Reset the alarm. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A094 Heatsink Overtemperature

A094	**Description**	The temperature detected on the IGBT heatsink is exceedingly high
Heatsink Overtemperature	**Event**	Overheating of the IGBT power heatsink.
	Possible Causes	Heatsink temperature exceedingly high.
	Solutions	Check the installation conditions and send a **RESET** command to reset the alarm. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A043, A049, A063, A071, A078, A087, A088, A092, A113 ÷ A122 Control Board Failure

A043 , A049, A063, A071, A078, A087, A088, A092 A113 ÷ A122	**Description**	Control Board Failure
	Event	Multiple causes are possible: the autodiagnostics function of the control board constantly checks its correct operation.
	Possible Causes	Strong electromagnetic disturbance. Possible failure of the microcontroller or other circuits in the control board.
	Solutions	Reset the alarm. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

A130 ÷ A135 ADC Channel Acquisition Error

A130 ÷ A135	**Description**	The system detected an error during measure acquisition through the ADC: A130 => CHANNEL 1 ACQUISITION ERROR A131 => CHANNEL 2 ACQUISITION ERROR A132 => CHANNEL 3 ACQUISITION ERROR A133 => CHANNEL 4 ACQUISITION ERROR A134 => CHANNEL 5 ACQUISITION ERROR A135 => CHANNEL 6 ACQUISITION ERROR
	Event	Wiring error or wiring failure.
	Possible Causes	Strong electromagnetic disturbance. Possible failure of the sensor connected to the respective ADC channel or failure of other circuits on the control board.
	Solutions	Reset the alarm. If the alarm persists, contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

2.9.4. List of the Warnings W03 ÷ W40

Warnings are service messages addressed to the user. They are displayed on one or two of the first three lines of the display/keypad module.

NOTE

Warnings are neither protections nor alarms and are not stored to the Fault list.

Some messages are only temporarily information displayed to explain to the user some particular operations or to suggest how to use the display/keypad module.

However, most messages are **encoded warnings**: the displayed code begins with a **W followed by two figures**, which specify the warning currently active.

W 2 1 C O N T R O L O N

Warning	Message	Description
W03	SEARCHING…	The user interface is searching for the data of the next page to be displayed.
W04	DATA READ KO	Software warning concerning data reading.
W05	DATA WRITE KO	Software warning concerning data writing.
W06	HOME SAVED	The current page has been stored as the first page to be displayed upon the next power on of the inverter.
W16	PLEASE WAIT	Wait for the operation requested to be completed.
W20	NOT NOW	You cannot perform this operation at the moment.
W21	CONTROL ON	The operation cannot be performed because the inverter is running.
W28	PV ISOL. KO	The galvanic isolation of the Main PV Field is KO.
W29	PVPOLAR.KO	PV field with **floating** Negative or Positive Earthed connection.
W30	PVISOL.+ KO	PV field with Positive Earth with **negative pole grounded**.
W31	PVISOL.- KO	PV field with Negative Earth with **positive pole grounded**.
W33	Write Impos.	The Write operation required cannot be performed.
W34	Illegal Data	An attempt has been made to write an invalid value.
W35	No Write CTR.	The Write operation requested cannot be performed because the Control is active and the inverter is running: **press the STOP button**.

Warning	Message	Description	
W36	Illegal Address	The Write operation requested cannot be performed because the address is wrong.	
W37	ENABLE LOCK	The inverter is disabled and does not acknowledge the **START** command because a C-type parameter is being written.	
		CAUTION	The inverter will start immediately as soon as the write operation is finished!!!
W39	KEYPAD DISAB	Accessing the programming mode is not allowed, since the display/keypad module is disabled.	
W40	ES847 KO	The Ambient Sensors and Field I/Os Expansion Board is not properly programmed or is damaged.	

2.10. Inverter Stop

To stop feeding power into the grid and stop the inverter, press the STOP button on the display/keypad module.

CAUTION

When an alarm message is displayed, always identify its cause prior to restarting the equipment.

DANGER

The STOP button does not cut-off power supply to the inverter. Therefore, its components are powered and dangerous even if the inverter has been set to STOP mode.

Any operations on the inverter must be performed under safety conditions, after cutting off both the DC power supply and the AC power supply.

Before carrying out any intervention on the connections wait at least 10 minutes after powering off the inverter, to allow the capacitors in the DC intermediate circuit to discharge.

3. ADVANCED INSTALLATION

3.1. Accessing the Inverter

3.1.1. Accessing the Terminal Boards

Access to the internal terminal boards is only required when the inverter is to be connected to ambient sensors, when the prewired grid cable is not adequate for the inverter or when a multi-inverter connection is required.

DANGER

Before accessing the inverter, cut-off the power supply and wait at least 10 minutes. There is a risk of electric shock even when the inverter is not powered, until the capacitors are fully discharged.

CAUTION

Do not connect/disconnect the signal terminals or the power terminals when the inverter is powered, such operation entailing the risk of electric shock and damage to the inverter.

NOTE

When wiring the inverter, the user is allowed to remove only the screws mentioned in these installation instructions. Removing other screws or bolts will void the inverter warranty.

To access the terminal boards, the covers of the SUNWAY M PLUS inverter have to be removed.

Perform the following operations to remove the external protection cover:

- Remove the two cross-headed screws located at the bottom.

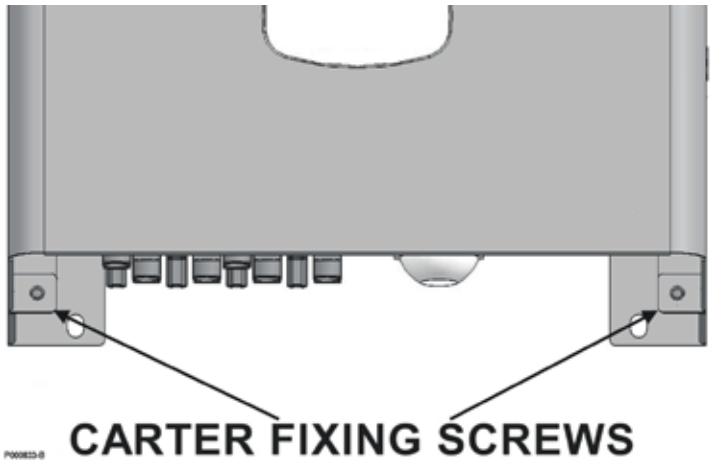


Figure 25: Location of the cover fixing screws

· Move the external cover downwards.

Figure 26: Action to perform to open the SUNWAY M PLUS

· Remove the external cover.

Figure 27: SUNWAY M PLUS with external cover disassembled

Internal cover removal:

- Remove the fixing screws of the internal cover.
- Lift the cover, taking care not to damage the wire connecting the control board to the display/keypad module.

Figure 28: Internal view of the SUNWAY M PLUS

Now you have access to the terminal boards prewired to the quick-coupling MC4 PV connectors and to the prewired grid cable, as well as to the terminals of the control board (see 7.8 Control Board Terminal Board).

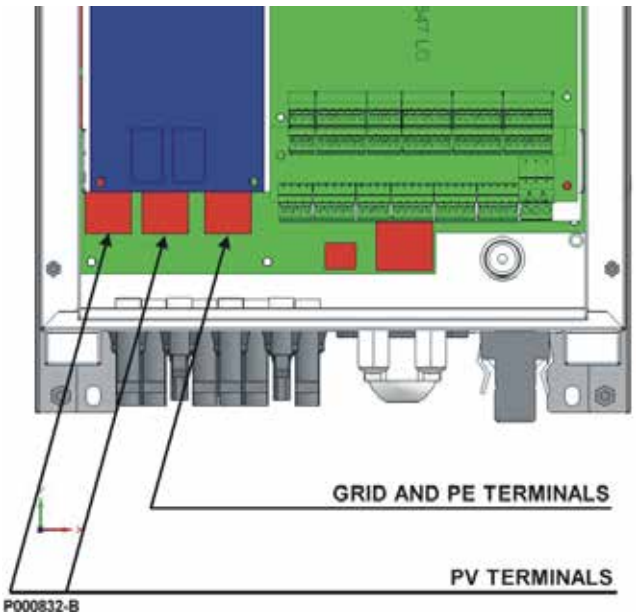


Figure 29: Location of the terminals for the connection to the grid and the Main PV Field

To close the SUNWAY M PLUS, perform the above-mentioned operations in reverse order:

- Close the internal cover by reinstalling the six fixing screws.
- Insert the external cover.
- Fix the external cover with the two fixing screws.

NOTE

All analogue and digital outputs are inactive under the following circumstances (digital outputs are inactive, analogue outputs are 0V/0mA):

- *inverter not powered*
- *inverter in initialization after start-up*
- *inverter in alarm status due to control board failure*
- *updating of the inverter application software*

It is recommended to take the above-mentioned conditions into account in relation to the specific application in which the inverter is to be used.

3.1.2. Grid Voltage Sensor Terminal Board

The grid voltage sensor terminal board is used in case of a multi-inverter connection and when an external relay is to be used as a grid interface protection. This terminal board allows acquiring measures from the grid downstream of an external parallel contactor.

To access this terminal board, remove the covers of the equipment (see 3.1.1 Accessing the Terminal Boards).

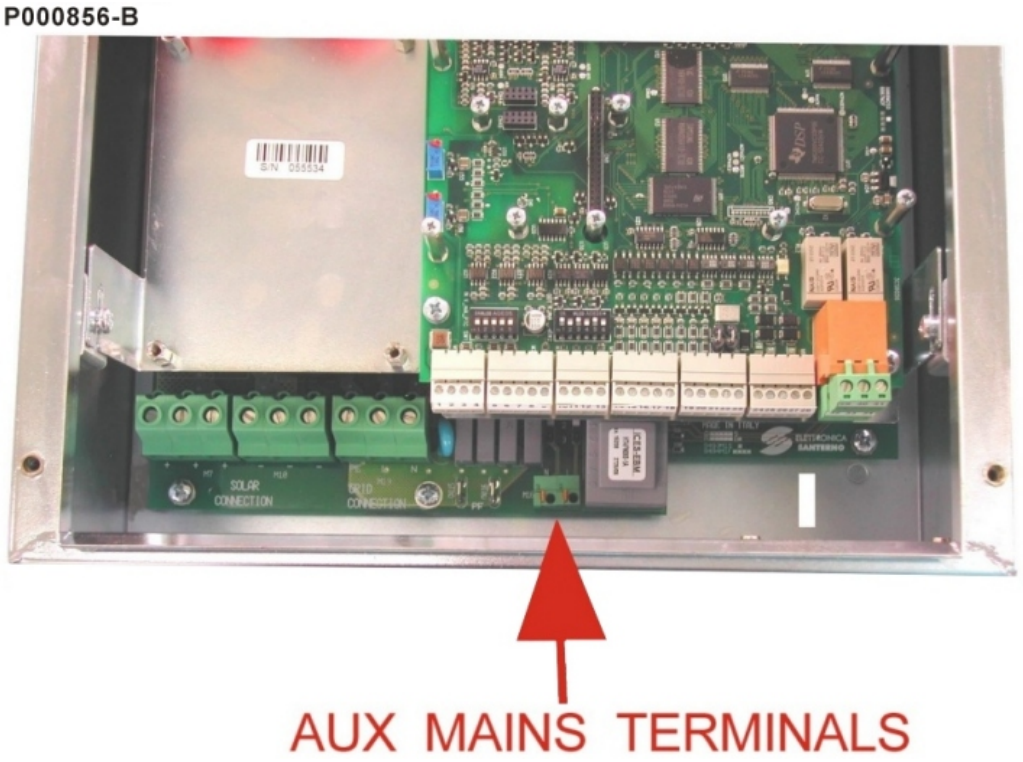


Figure 30: Grid voltage sensor terminal board

The specifications of the terminal board are described in the table below:

N.	Name	Description	Type of Terminal	Min. Cable Section [mm2]	Max. Cable Section [mm2]	Length of cable stripping [mm]
1	L-mains aux	Mains auxiliary connection	Spring-type	0.2	1.5	10
2	N-mains aux					

Table 13: Terminal board specifications

3.2. Serial Communications

3.2.1. General Information

The inverters of the SUNWAY M PLUS series can be connected to a PC through a serial link. This allows access, both in reading and in writing mode, to all the parameters normally managed through the display/keypad, and the acquisition of the data processed by the inverters.

Up to 247 devices (SUNWAY M PLUS inverters, ambient signals acquisition systems, etc.) can be connected to the local PC, provided that the Modbus RTU protocol is used. The 3-wire RS485 standard is used, which ensures better immunity to disturbance even on long cable paths, thus limiting communication errors.

The inverter behaves as a slave device (i.e. it can only answer to queries sent by another device); a master device (the PC or a Data Logger board) is then needed to implement serial communication.

The SUNWAY M PLUS may be connected directly to a computer or a multidrop network of devices (SUNWAY M PLUS inverters, ambient signals acquisition systems, etc.) controlled by a master PC (see Figure 32).

It is also possible for the user to connect to the PV plant with a remote PC connected to the local PC through an RS485 link, LAN network or Modem on switched telephone line, or via the Internet through the Link service offered by Elettronica Santerno.

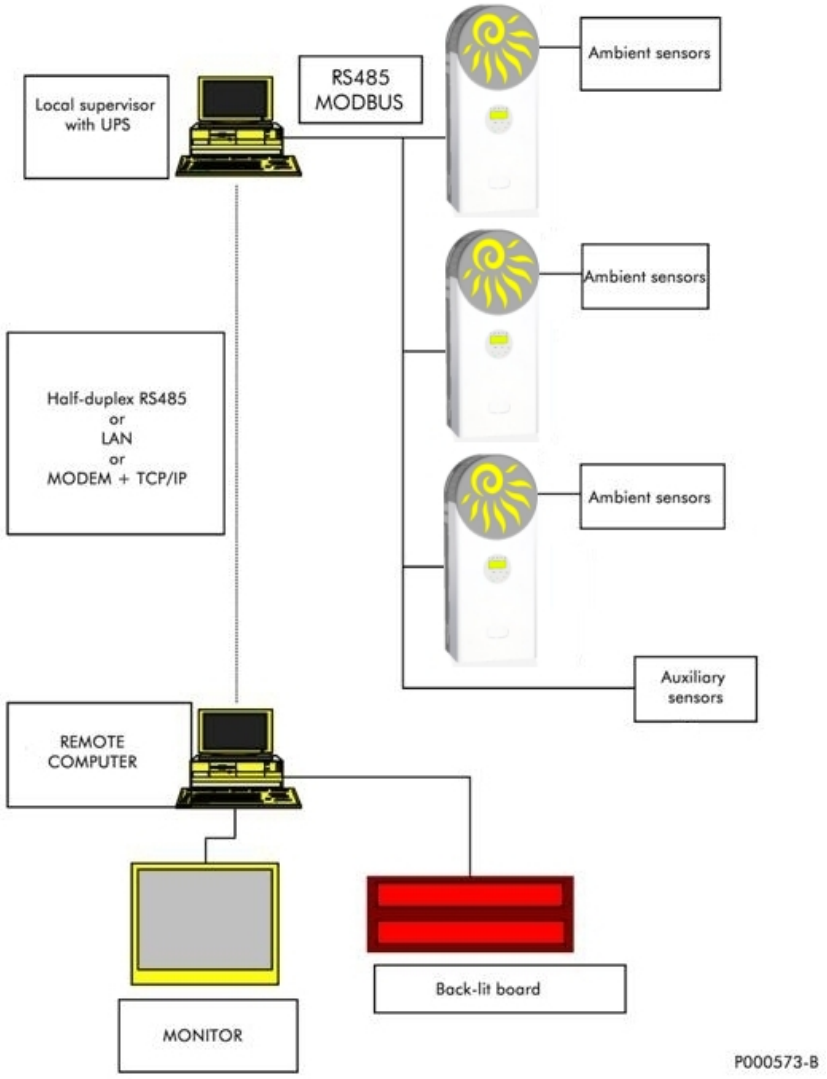


Figure 31: Example of a SUNWAY M PLUS connected to a communication network

The Remote Sunway software developed by Elettronica Santerno allows using a PC as the Master device. The Remote Sunway software allows image acquisition, keypad simulation, oscilloscope and multifunction tester, table compiler for history data, parameter setting, data acquisition/transmission/storage from and to the PC, scan function for the automatic detection of the connected inverters (up to 247). The Remote Sunway software is also able to perform the remote controlling of a network of devices of the PV products line. For further information on the use of this software, refer to the relevant user manual.

3.2.2. Direct Linking

If a direct linking configuration is chosen, the electrical standard RS485 may be used provided that the PC is equipped with a port of this type. If the PC is equipped only with a serial RS232-C port or a USB port, as it typically is, a RS232-C/RS485 converter or a USB/RS485 converter is required.

Logic '1' (usually called a 'MARK') means that terminal TX/RX A is positive with respect to terminal TX/RX B (vice-versa for logic '0', usually called a 'SPACE').

3.2.3. Network Connections

The electrical standard RS485 allows the SUNWAY M PLUS to be connected to a network of inverters, under a multidrop configuration to which the single devices are linked. Up to 247 inverters may be interconnected depending on the link length and transmission rate.

The connection limit of the line drives is actually of 30 devices. If more than 30 devices are to be connected to the same line, or if the line length exceeds 500 m, the line should be broken up into smaller segments using RS485 repeaters.

Each inverter has its own ID number that identifies it univocally in the network mastered by the PC. The ID number can be set in the SERIAL LINKS MENU R001 ÷ R006.

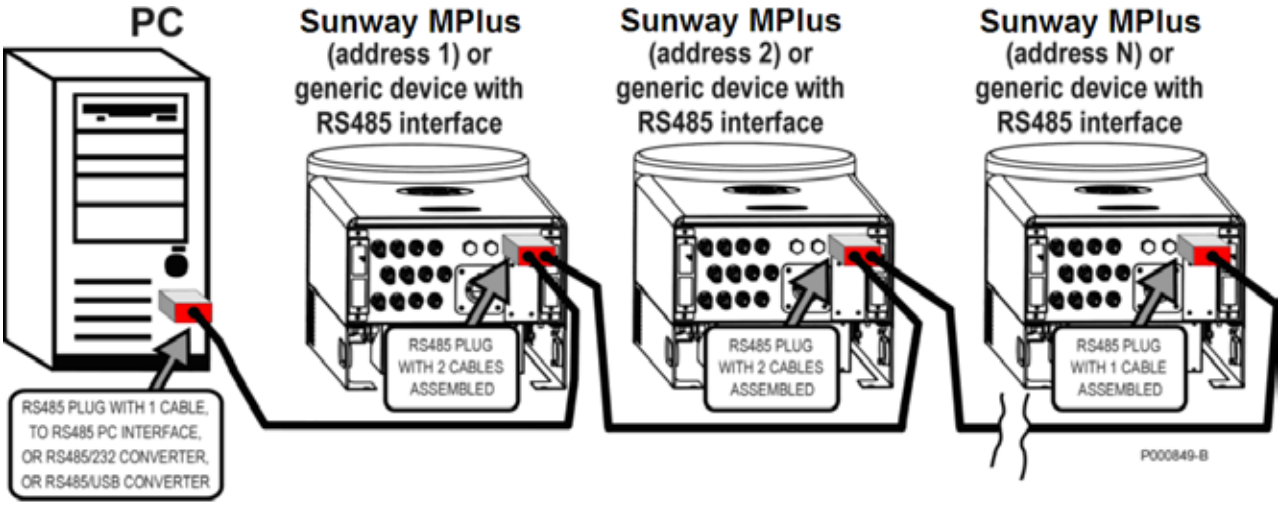

PC
Sunway MPlus (address 1) or generic device with RS485 interface
Sunway MPlus (address 2) or generic device with RS485 interface
Sunway MPlus (address N) or generic device with RS485 interface
RS485 PLUG WITH 2 CABLES ASSEMBLED
RS485 PLUG WITH 2 CABLES ASSEMBLED
RS485 PLUG WITH 1 CABLE ASSEMBLED
RS485 PLUG WITH 1 CABLE, TO RS485 PC INTERFACE, OR RS485/232 CONVERTER, OR RS485/USB CONVERTER
P000849-B

Figure 32: Multidrop network with RS485 connectors

NOTE

The generic device in Figure 32 may be a SUNWAY M PLUS inverter, or an ambient sensor (e.g. a DATEXEL 3017 or 3148).

3.2.4. Connection

The 9-pole, male D connector located beneath the front cover of the inverter is to be used to connect to the serial link RS485.

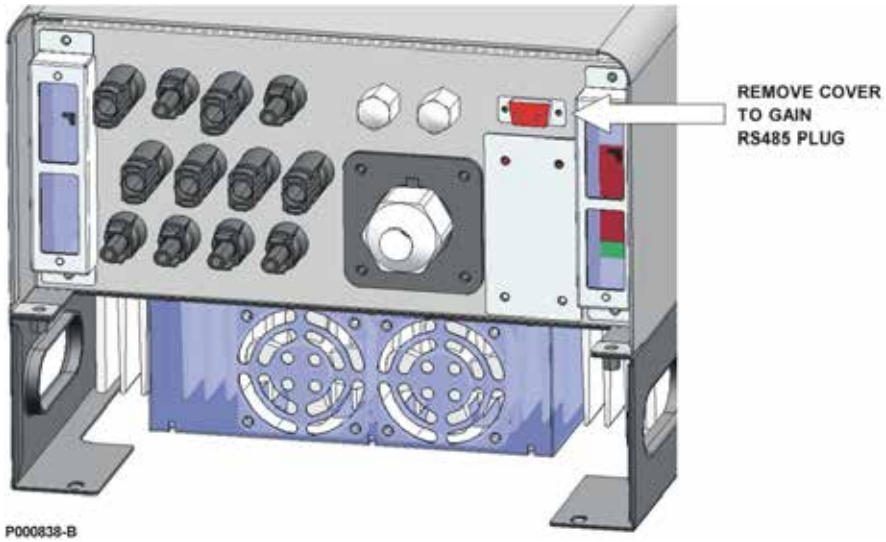


Figure 33: Location of the DB9 connector for the implementation of the RS485 serial link

The pins-signals matching are described in the table below.

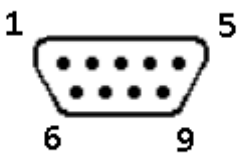
Pin of the DB9 Connector	Name	Function
1 – 3	A-Line	(TX/RX A) Differential input/output A (bidirectional) depending on standard RS485. Positive polarity with respect to pins 2 – 4 for one MARK.
2 – 4	B-Line	(TX/RX A) Differential input/output B (bidirectional) depending on standard RS485. Negative polarity with respect to pins 1 – 3 for one MARK.
5	GND	(0 V) Control board zero volts.
6	N.C.	(VTEST) Test power supply input – **Do not connect**
7 – 8	GND	Not connected
9	+5V	+5 V, max. 100mA for power supply to an external optional convertor RS485/RS232 or RS485/USB (if any).
PIN NUMBERING		

Table 14: Pins-signals matching

The metal case of the connector is connected to the inverter grounding. Connect the braid of the shielded duplex cable used for serial communications to the metal case of the female connector that is to be connected to the inverter.

3.2.4.1. General Principles of the RS485 Bus

The Modbus-IDA association (http://www.modbus.org) defines the type of connection for Modbus communications over serial link RS485, which is used by the inverter, as a '2-wire cable' configuration. The following specifications are recommended for the cable:

Connection Cable	
Type of cable	Shielded cable composed of a balanced pair named D1/D0 + common conductor ("Common")
Min. cross-section of the conductors	AWG24 corresponding to 0.25sqmm; for important lengths, cross-sections up to 0.75sqmm are recommended
Max. length	500 metres, referred to the max distance measured between any two stations
Characteristic impedance	Greater than 100W (recommended), typically 120W.

Table 15: RS485 connection cable

The typical wiring diagram recommended by the Modbus-IDA association for the connection of '2-wire' devices is shown in the figure below.

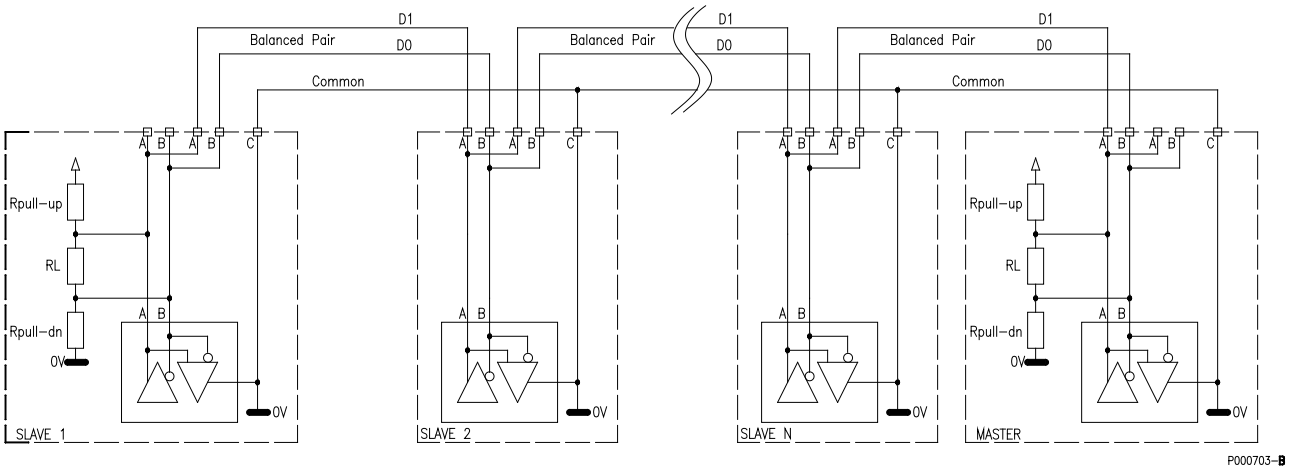


Figure 34: Recommended Modbus wiring diagram for '2-wire' devices

It is important to note that the network composed of the termination resistor and the polarization resistors is incorporated into the inverter for convenience of use, and can be enabled through the DIP-switches. Figure 34 shows the termination diagram only for the devices at the ends of the chain, since the terminator is to be enabled only at them.

NOTE

It is advisable that all the devices connected to the communication multidrop network be wired sharing their common conductor (0V), to minimize any difference of ground potentials between devices, which may adversely affect communications.

The common of the power supply to the inverter control board is isolated from ground. If one or multiple inverters are connected to a communication device with a grounded common (typically a PC), a low-impedance path between control boards and grounding results. High-frequency conducted disturbance coming from the inverter power components could affect this path, causing malfunctions to the communication system.

If this happens, provide the communication system with a galvanically isolated communications interface RS485 or with a galvanically isolated RS485/RS-232 converter.

3.2.5. Line Terminators

Multidrop line RS485 connecting to multiple devices must be wired using a linear wiring (not a star wiring): each device connected to the line has to be reached by the cable coming from the preceding device, and be connected to the device coming next on the line. For this purpose, two pins for each line signal are provided on the inverter connector. The incoming line can be connected to pins 1 and 2, whereas the outgoing line can be connected to pins 3 and 4.

Obviously, the first device in the multidrop chain will have only one outgoing line, while the last device will have only one incoming line. Therefore, the line terminator is to be installed on the first device and the last device.

To select the line terminator on the SUNWAY inverters, it is sufficient to open the inverter cover and change the configuration of the dip-switch located next to the 9-pole D-connector on the control board (if only one Sunway inverter is connected).

In the most frequent case, where one line Master (a PC) is installed on one end of the line, the inverter installed at the farthest point (or the only inverter in case of direct connection) must have the line terminator enabled: DIP-switch selector switches 1 and 2 ‘ON’. The line terminator of the other inverters installed in intermediate positions must be disabled: DIP-switch selector switches 1 and 2 ‘OFF’.

NOTE

Communication does not take place or is adversely affected if multidrop terminators are not properly set, especially in case of high baud rate. If more than two terminators are fitted on a line, some drivers can enter the protection mode due to overheating, thus cutting off the communication of some of the connected devices.

3.2.5.1. Configuration DIP-switches

The configuration of the terminators of the serial link RS485 is done through the DIP-switch SW3. To access it on the control board, open the SUNWAY M PLUS following the procedure described in section 3.1 Accessing the Inverter.

DANGER

Before accessing the inverter, cut-off the power supply and wait at least 10 minutes. There is a risk of electric shock even when the inverter is not powered, until the capacitors are fully discharged.

CAUTION

Do not connect/disconnect the signal terminals or the power terminals when the inverter is powered, such operation entailing the risk of electric shock and damage to the inverter.

NOTE

When wiring the inverter, the user is allowed to remove only the screws mentioned in these installation instructions. Removing other screws or bolts will void the inverter warranty.

Figure 35: Location of the DIP-switches and serial link terminators

The factory settings are described in the table below.

DIP-switch	Function	Factory setting
SW3-1 SW3-2	RS485 terminator	**Both ON**: RS485 terminator enabled

Table 16: DIP-switch: RS485 serial link terminator

3.2.6. Communication Protocol

The serial communications protocol implemented is the Modbus RTU standard.

The inverter parameters are queried simultaneously to their reading on the display/keypad, so that both devices can be used at a time. Parameter modification is also managed along with the display/keypad. Note that the inverter will always consider the latest value set either via serial link or through the display/keypad.

3.3. Multi-inverter Connection

3.3.1. Description of the Application

This application refers to multiple devices installed at the same Connection Point.

NOTE

The maximum value of the power imbalance between two phases and the need for an external protection relay interface changes depending on the country. Refer to the specific standards applicable to the site of installation.

The maximum value of power imbalance between two phases changes depending on the country in which the equipment is installed. Check the value of parameter P128, maximum power imbalance between the phases, described in the “Certification and Grid Interface File”.

When using **up to three devices** there are no specific measures to be implemented, except for the fact that the maximum value of power imbalance between the phases must be respected. It is nonetheless advisable to distribute as evenly as possible the power between the phases.

3.3.2. Wiring Diagram without External Interface Protection Relay

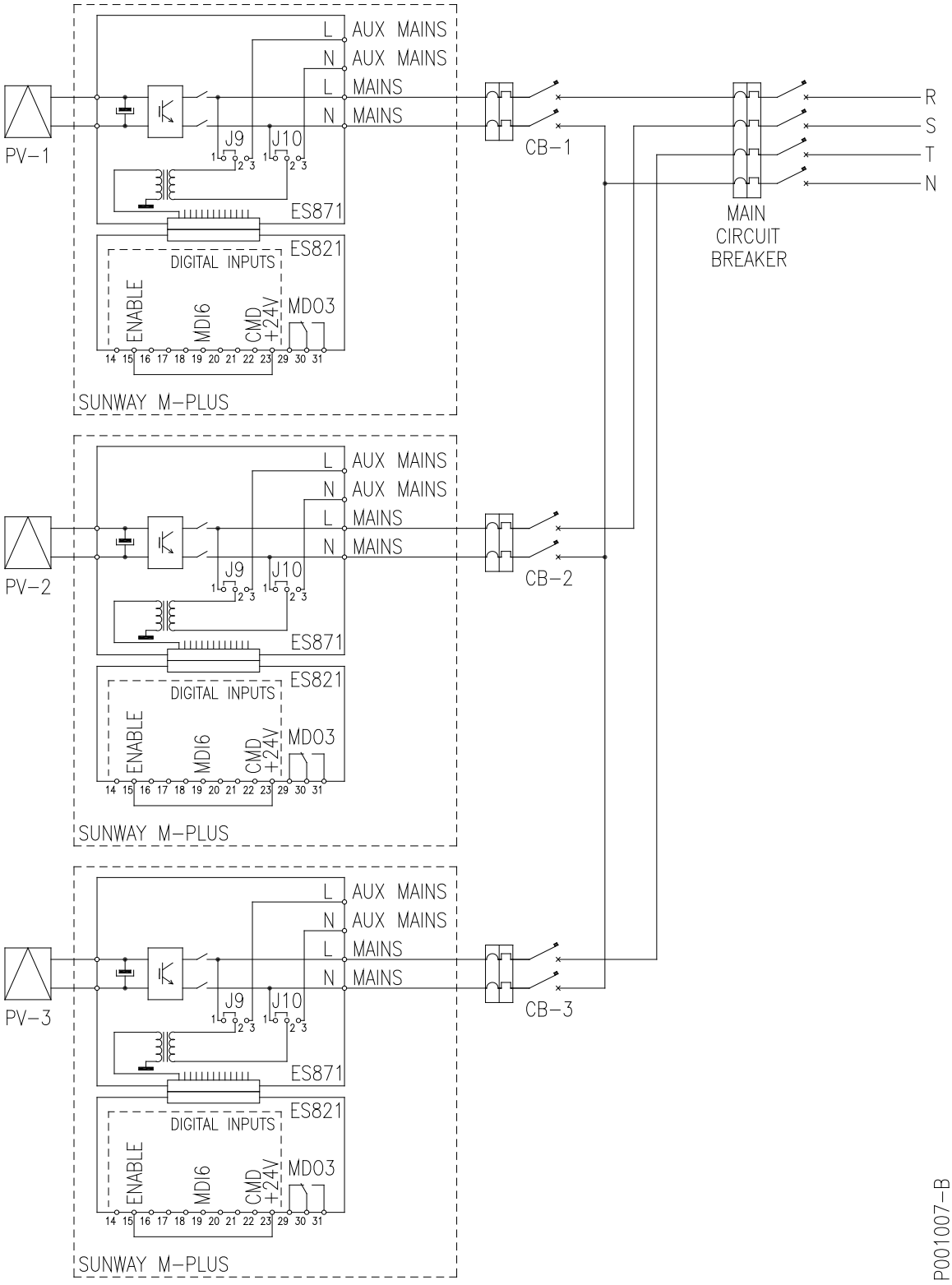


Figure 36: Wiring diagram without external interface protection relay

3.3.3. Wiring Diagram with External Interface Protection Relay

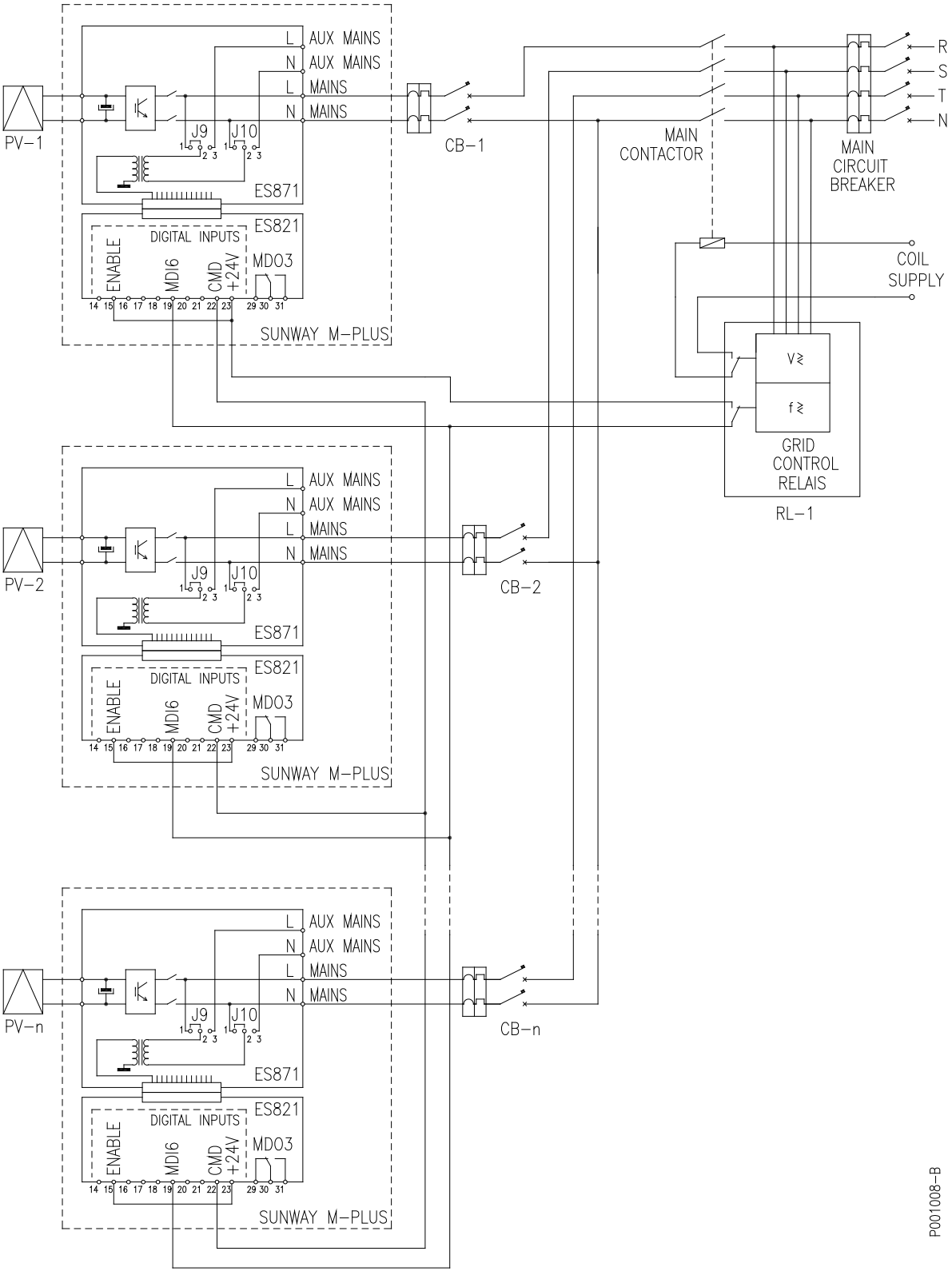


Figure 37: Wiring diagram with external interface protection relay

NOTE

Distribute the devices between the three phases so that the difference of installed power between two phases does not exceed the value set in P128.

3.3.4. Ratings of the External Components in the Multi-inverter Configuration

The ratings of the external components are to be based on the following criteria:

Component	Function	Dimensioning	Notes
MAIN CONTACTOR	Inverter disconnecting contactor	Min rated voltage: 400 Vac Rated voltage in AC-3: 30 A	Only installed for >3 multi-inverter configuration
CB-1,2..n	Safety circuit breaker of each inverter	See table in section 7.6 GENERAL INFORMATION ON the SUNWAY M PLUS	
MAIN CIRCUIT BREAKER	Main circuit breaker	Min rated voltage: 250 Vac Rated voltage: 32 A	
RL1	Grid interface protection relay		Must comply with the standards in force and must have the approvals required for the specific site of installation.

Table 17: Ratings of the external components in the multi-inverter configuration

3.3.5. Parameterization for Multi-Inverter Connection

When more than three inverters are connected to the same plant, parameter **C006** must be programmed accordingly on each SUNWAY M PLUS. Refer to the MANAGER MENU C000 ÷ C008, R020 ÷ R021.

3.3.6. EquiPhase Control

The configuration of the SUNWAY M PLUS on distinct phases of a three-phase line is limited to three devices (three-single-phase) if the rated output power of the model used is greater than the maximum power permitted by the applicable regulation. For this reason, an algorithm is used for the coordination between the inverters, called EquiPhase Control, which can reduce the power imbalance on the three phases depending on the value of parameter P128. Such coordination requires additional wiring between the devices (see Figure 38).

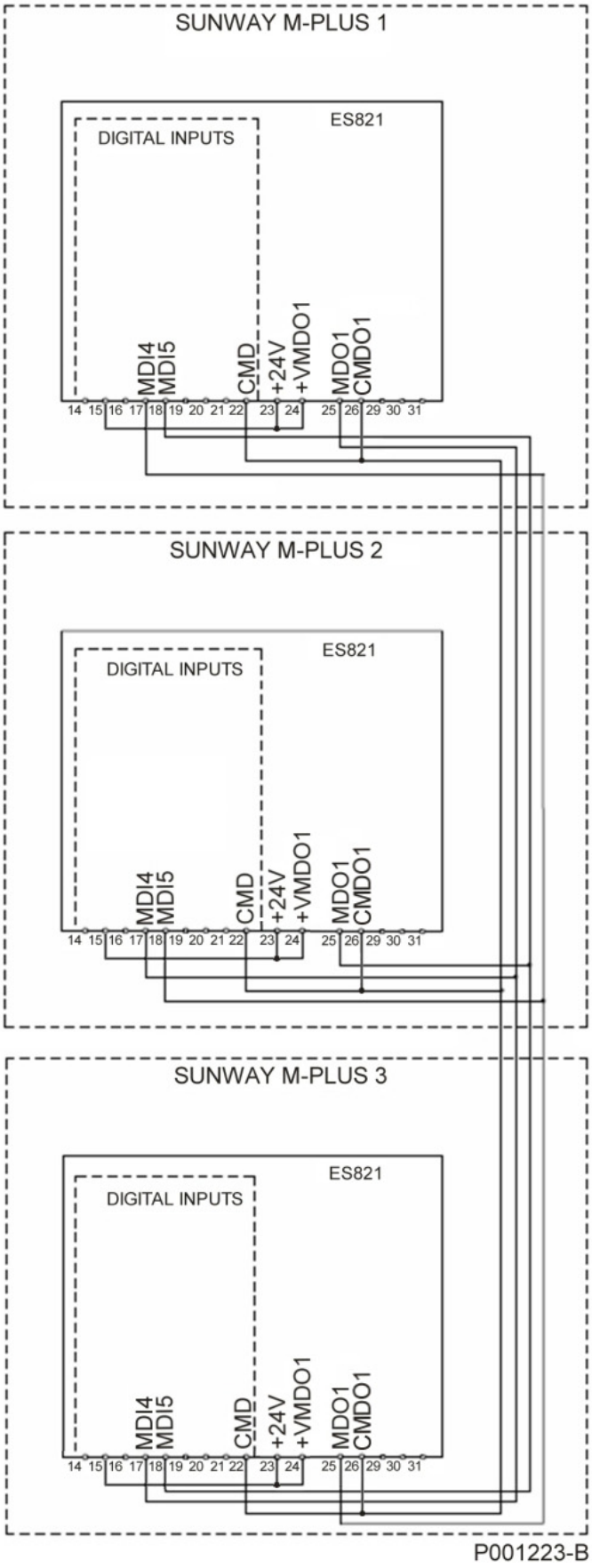


Figure 38: Wiring between multiple SUNWAY M PLUS inverters with the EquiPhase Control function

The MDO1 output of each inverter is connected to the MDI4 and MDI5 inputs of the other two inverters. Each inverter activates its MDO1 output if its power output drops below a preset threshold. The other two inverters are then prompted to decrease their power output accordingly, to limit the maximum phase power imbalance with respect to the value defined by P128.

3.3.7. Inverter with Earlier Software Versions

CAUTION

In countries implementing the VDE 126-1-1 standard for the connection to the grid, if the software version is older than the 1.67, the inverter must be equipped with an automatic disconnection device (ENS).

The maximum value for the power imbalance between two phases changes depending on the country of installation. Check the value of parameter P128, maximum power imbalance between the phases, described in the “Certification and Grid Interface File”.

The multi-inverter configuration is only possible when accompanied by an ENS31 automatic grid disconnection device for three-phase applications, or by three ENS26 for single-phase applications.

CAUTION

Refer to the Installation Manual of the automatic grid disconnection device ENS26 UFE for connections to the grid.

NOTE

For further information, contact Elettronica Santerno’s AFTER-SALE SERVICE.

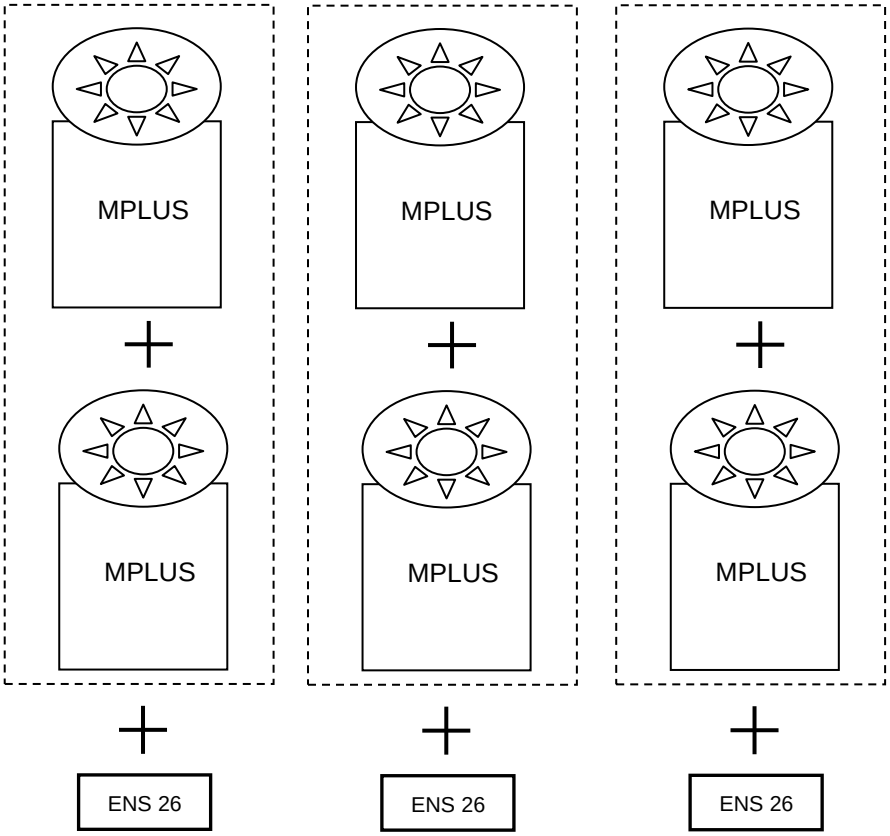


Figure 39: Multi-inverter configuration of SUNWAY M PLUS 2600E with single-phase ENS

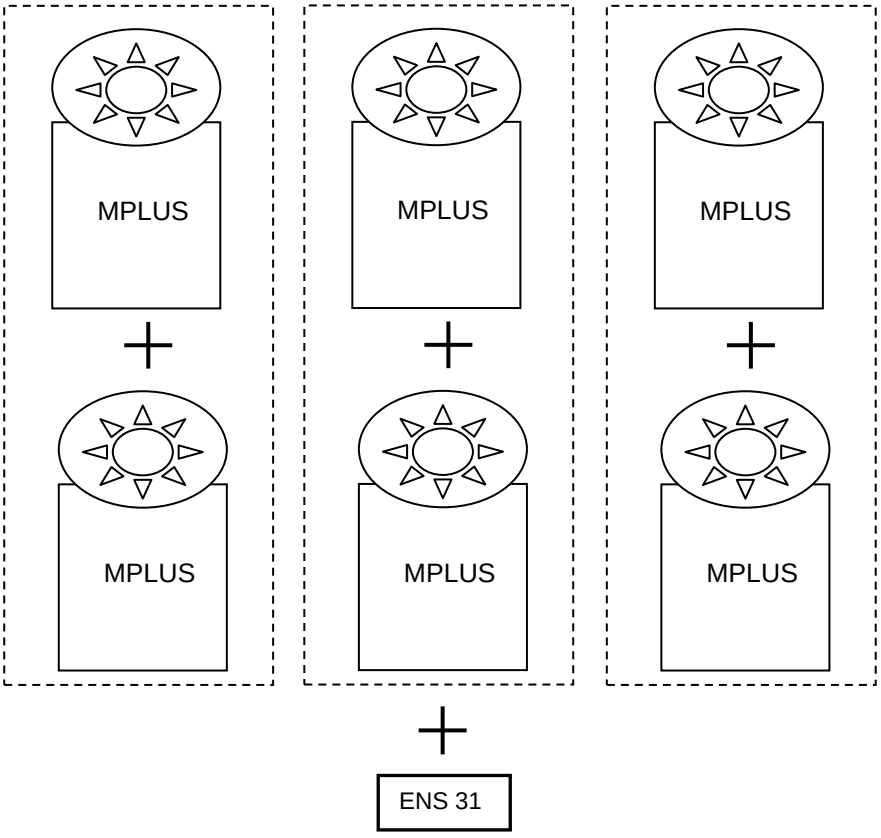


Figure 40: Multi-inverter configuration of SUNWAY M PLUS 2600E with three-phase ENS

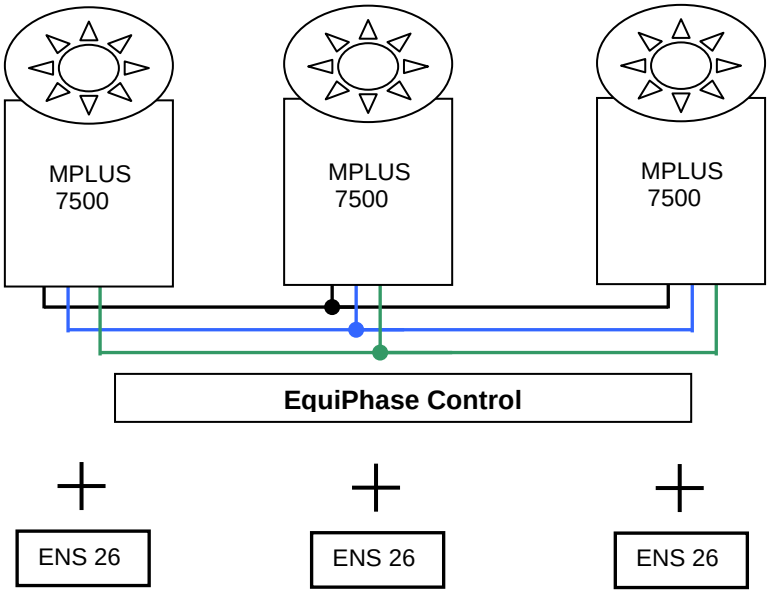


Figure 41: Multi-inverter configuration with EquiPhase Control and single-phase ENS

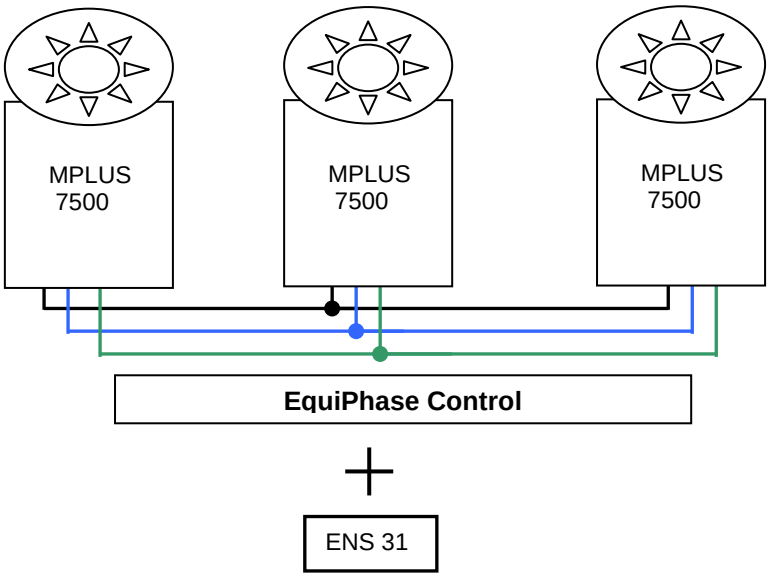


Figure 42: Multi-inverter configuration with EquiPhase Control and three-phase ENS

3.4. Ambient Signals

3.4.1. Ambient Signals Factory Settings

Up to three ambient signals can be connected to the SUNWAY M PLUS (solar radiation, module temperature, ambient temperature). The measures of these signals are then available both for displaying on the display/keypad and for communication via the serial link.

Ambient signals must be connected to the three analogue inputs in control board ES821. Their factory setting is given in Table 18: Factory settings of the ambient signals on the control board:

Type of signal processed	Factory setting of the signal	Terminal on the control board		Name
Solar radiation	Voltage: 0 ÷ 10 V	2	SW1-1: Off	2-REF
Module temperature	Current: 0(4) ÷ 20 mA	5-6	SW1-2: On	AIN1+/AIN1-
Ambient temperature	Current: 0(4) ÷ 20 mA	7-8	SW1-3: On SW1-4.5: Off	AIN2+/AIN2-

Table 18: Factory settings of the ambient signals on the control board

NOTE

*If the **Additional Photovoltaic Field** option is implemented, terminals for ambient signals 1, 2 and 3 are no longer available. If ambient measures are to be acquired when the **Additional Photovoltaic Field** is installed, use the **Ambient Sensors and I/O Expansion Board** option.*

3.4.2. Customization of the Ambient Signals

If the factory settings of the ambient signals need to be modified, Table 87: Control board terminal board provides all the necessary information for their configuration and a detailed description of the terminals of the control board dedicated to the ambient signals.

The selection between voltage input and current loop input is done through the configuration DIP-switches located on the control board.

NOTE

The software parameter settings must be consistent with the dip-switch settings. If the hardware configuration is not consistent with the type of acquisition set in the parameters, also the results will not be consistent with respect to the values acquired.

Any voltage or current value exceeding the max or min full-scale values will generate an acquired value limited to the max measure or the min measure respectively.

Voltage-set inputs have a high input impedance and must always be closed when active. Interrupting the conductor connected to an analogue input set as a voltage input will not ensure that its channel reading will be equal to zero. Zero is read only if the input is wired to a low-impedance signal source or if it is short-circuited. Therefore, do not install relay contacts in series to the inputs to set the value reading to zero.

The picture below shows the location of the DIP-switch SW1 in the control board. To access the control board, open the SUNWAY M PLUS following the procedure described in section 3.1 Accessing the Inverter.

DANGER

Before accessing the inverter, cut-off the power supply and wait at least 10 minutes. There is a risk of electric shock even when the inverter is not powered, until the capacitors are fully discharged.

CAUTION

Do not connect/disconnect the signal terminals or the power terminals when the inverter is powered, such operation entailing the risk of electric shock and damage to the inverter.

NOTA

When wiring the inverter, the user is allowed to remove only the screws mentioned in these installation instructions. Removing other screws or bolts will void the inverter warranty.

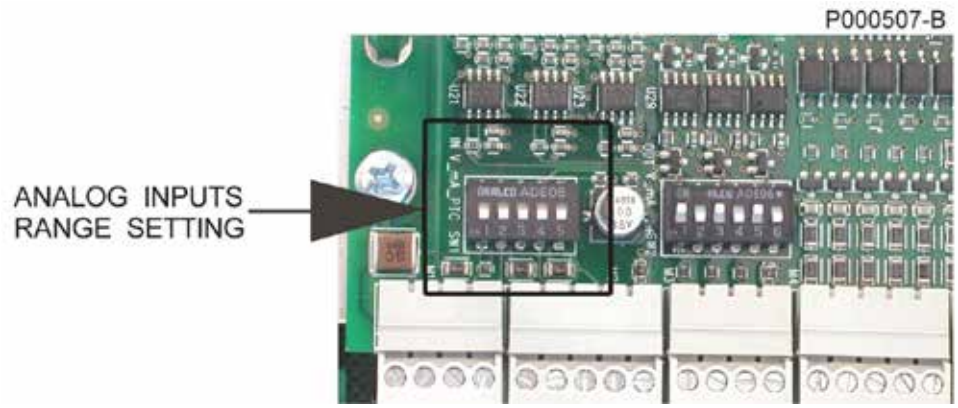


Figure 43: Location of DIP-switch SW1 on the control board

3.4.3. Ambient Signals Connection

3.4.3.1. Solar Radiation Input: Terminals 1 (CMA) and 2 (REF)

The input for solar radiation is a single-ended input referred to terminal CMA (1).

The diagrams below show some example of connections of a sensor with a unipolar voltage output and a sensor with a 4÷20mA current output.

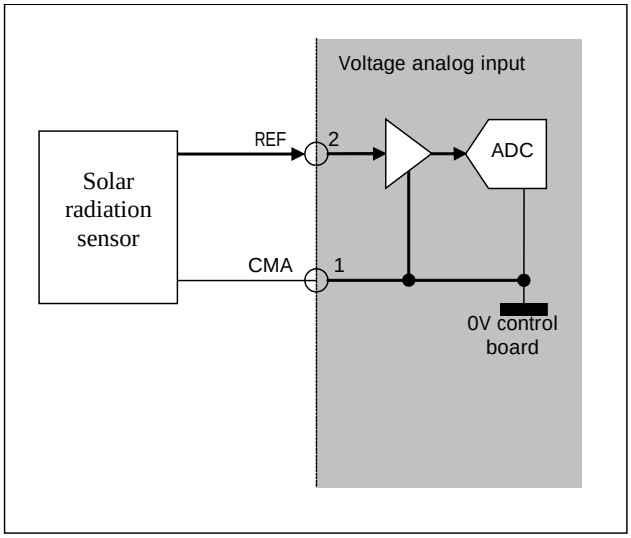


Figure 44: Connection of a sensor with 0÷10V unip. voltage output to the solar radiation input (REF).

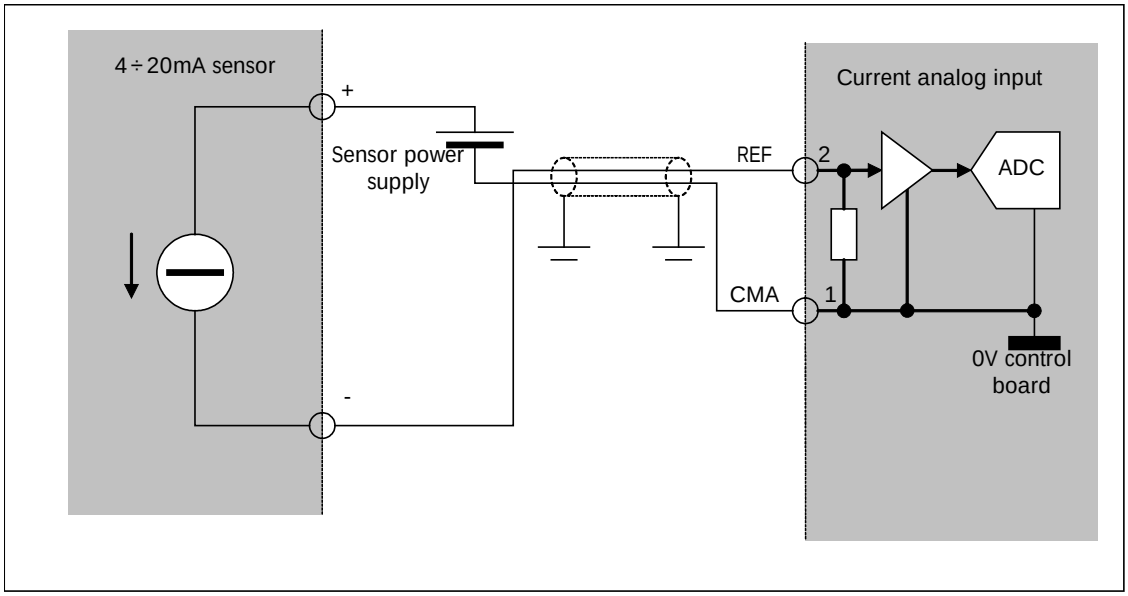


Figure 45: Connection of a 4÷20mA sensor to the solar radiation input (REF).

NOTE

The +24V power supply available from terminal 23 in the control board is referred to the common of the digital inputs (CMD – terminal 22), not to the common of the CMA analogue inputs. It can be used to supply 4÷20mA sensors by connecting one of the commons of the CMA analogue inputs (terminals 1, 9 or 13) with the common of the CMD digital inputs (terminal 22). When using the +24V power supply, remember that the max allowable current is 100mA.

3.4.3.2. Inputs for Ambient Temperature and Modules Temperature: Terminals 5, 6 and 7, 8

The differential inputs allow performing external voltage/current measurements on off-ground signals up to a preset maximum value of common-mode voltage.

The differential input allows limiting the disturbance due to 'ground potentials' that may occur when the signal is acquired from distant sources. Disturbance is limited effectively only if the wiring is correct.

Each input has two terminals: a positive terminal and a negative terminal of the differential amplifier. These terminals are to be connected to the signal source and the signal ground respectively. Make sure that the common-mode voltage between the ground of the signal source and the ground of the CMA auxiliary inputs (terminal 9) does not exceed the max allowable value of common-mode voltage.

When the input is used for current input acquisition, the differential amplifier reads the voltage produced at the ends of a dropping resistance with low ohmic value. Even in that case, the current return, and therefore the negative terminal of the differential input, should have a maximum potential not exceeding the common-mode voltage value.

As a general rule, to exploit the disturbance rejection benefits at the differential input it is necessary to:

- Provide a common path for the differential pair.
- Connect the source ground so that it does not exceed the maximum common-mode voltage of the inputs.

The diagrams below describe the connections typically used.

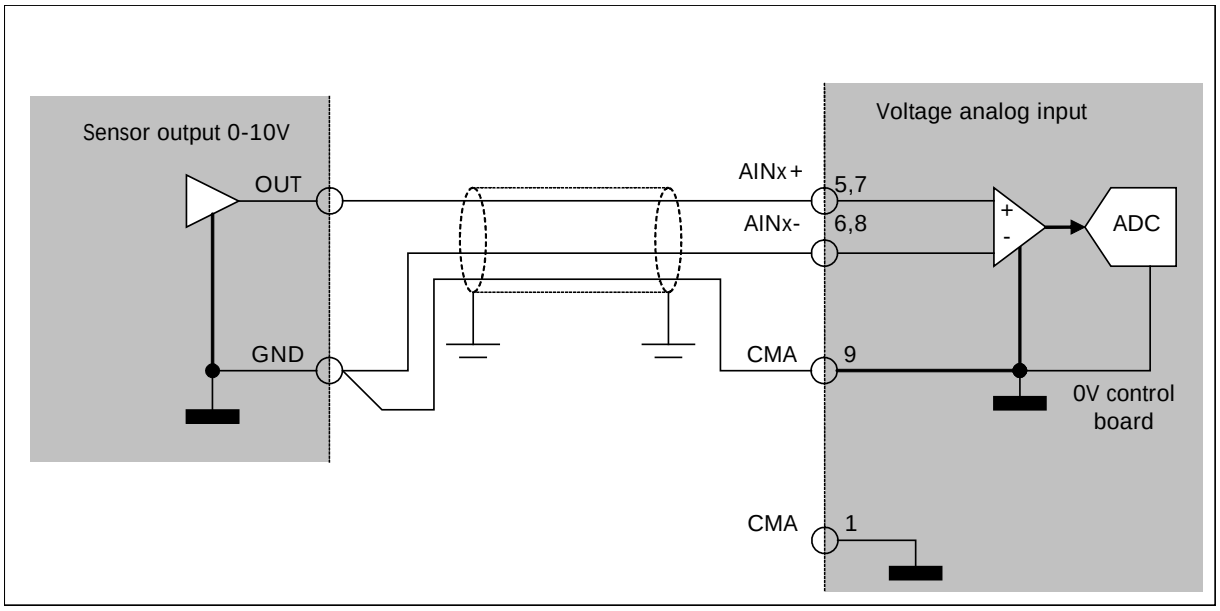


Figure 46: Connection of a 0÷10V sensor to the temperature inputs (AIN1/AIN2)

NOTE

Connecting the CMA terminal to the signal source ground is essential to ensure the quality of the signal acquired. The connection may also be performed externally to the screened cable.

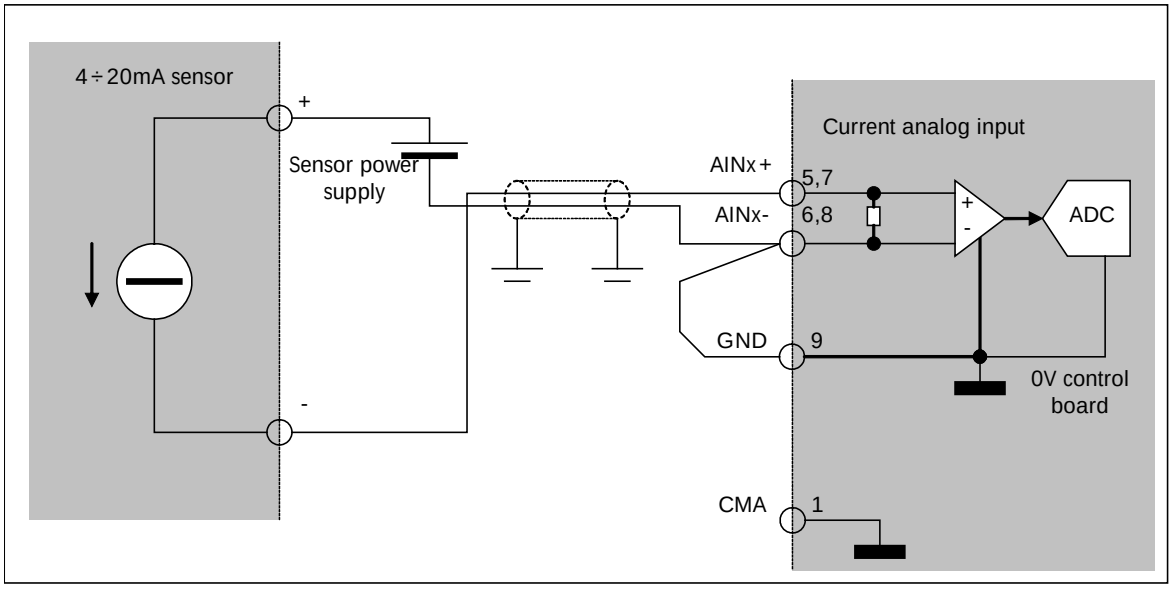


Figure 47: Connection of a 4÷20mA sensor to the temperature inputs (AIN1/AIN2)

The specifications of the ambient signals are provided in Table 88: Technical specifications of the ambient signals.

3.4.4. Configuration Parameters for Ambient Signals Acquisition

The configuration parameters for ambient signals acquisition are described in Table 19: Ambient signals configuration parameters

Function		Solar Radiation REF Input	Ambient Temperature AIN1 Input	Modules Temp. AIN2 input
Mode	Parameter	P050	P055	P060
Offset	Parameter	P051	P056	P061
Disturbance filter	Parameter	P052	P057	P062
Min value	Parameter	P053	P058	P063
Full-scale	Parameter	P054	P059	P064

Table 19: Ambient signals configuration parameters

Full details for these parameters are provided in section 5 PROGRAMMING.

4. OPTIONS

4.1. Ambient Sensors and Field I/Os Expansion Board

The SUNWAY M PLUS can be equipped with an expansion board for ambient sensors and field inputs/outputs, allowing connecting six ambient signals in addition to the three standard ambient signals available on the control board.

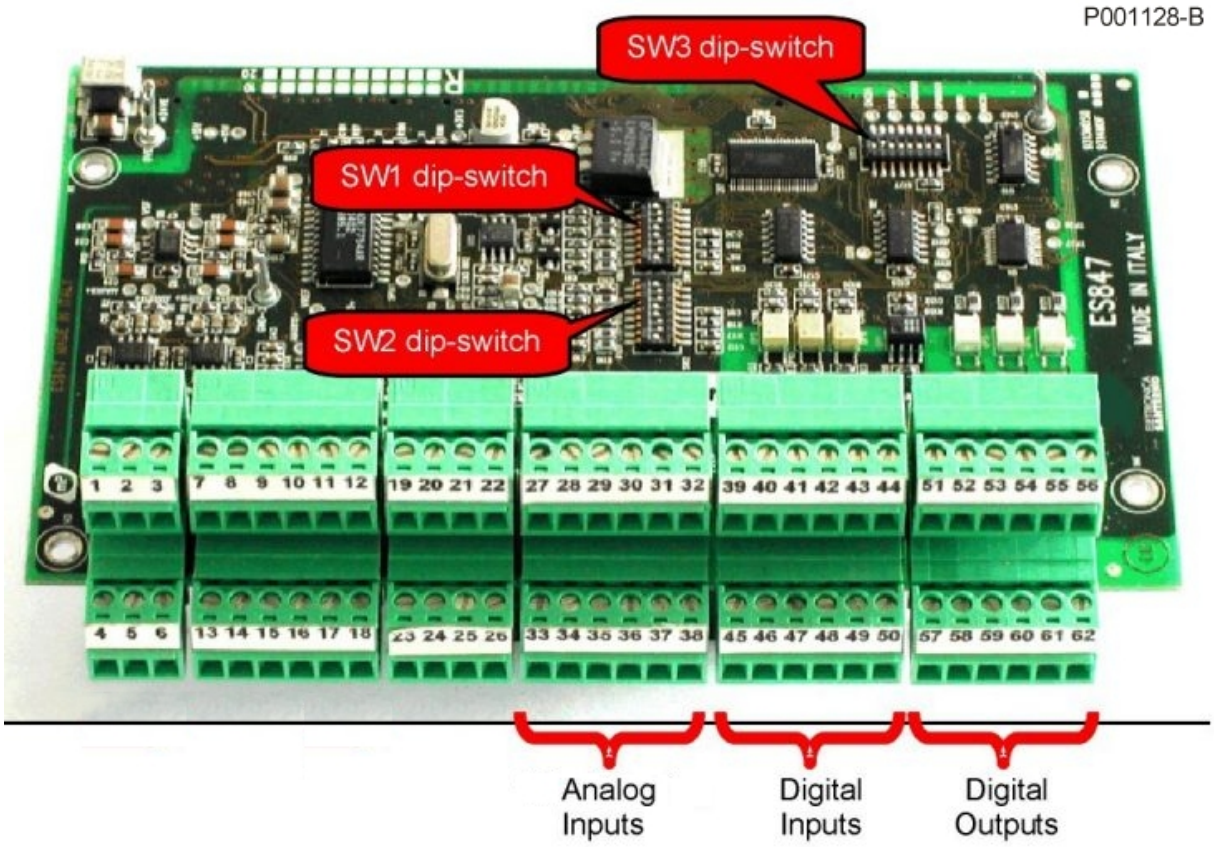


Figure 48: Ambient sensors and field I/Os expansion board

The Ambient Sensors and Field I/Os Expansion Board is a general-purpose board for the expansion of the control board. It has several functions, as described below (only the functions applicable to the SUNWAY M PLUS are described):

The factory setting of the six ambient inputs is specified in Table 20: Optional configuration of ambient signals inputs.

- Four 12-bit inputs that can be configured as f.s. 0÷10V, f.s. 0÷20 mA, f.s. 0÷100 mV; temperature acquisition with 2-wire PT100.
- Two 12-bit inputs, f.s. 0-10V.

Ambient Measure	Type of Factory-Set Sensor	Factory Setting	Type of Measure
Ambient Measure 4	Sample Cell	0 ÷ 100 mV	Solar radiation on modules
Ambient Measure 5	Sample Cell	0 ÷ 100 mV	Solar radiation on horizontal plane
Ambient Measure 6	Thermocouple	PT100	Ambient temperature
Ambient Measure 7	Thermocouple	PT100	Modules temperature
Ambient Measure 8	Anemometer	0 ÷ 10 V	Wind direction
Ambient Measure 9	Anemometer	0 ÷ 10 V	Wind speed

Table 20: Optional configuration of ambient signals inputs

The Ambient Sensors and Field I/Os Expansion Board allows connecting one or two external pulse counters to measure the energy fed into the grid and the energy absorbed.

NOTE

Option to be ordered together with the inverter.

The specifications are provided in section 7 TECHNICAL SPECIFICATIONS.

4.1.1. Configuration DIP-Switches

The expansion board is provided with three configuration dip-switches (see Figure 48) that allow setting the operating mode, as described in Table 21.

DIP-Switch	Function
SW1	Sets the operating mode for ambient analogue inputs 4-5
SW2	Sets the operating mode for ambient analogue inputs 6-7
SW3	Factory-set configuration: SW3.2 = ON, SW3.5 = ON, all others OFF **(do not modify)**

Table 21: Functions of the 3 DIP-switches on the Ambient Signals and Field I/Os Expansion Board

The following tables show the possible configurations of the DIP-switches SW1 and SW2 according to the desired setting of the analogue channels.

SW1

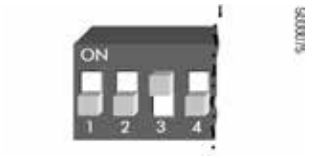
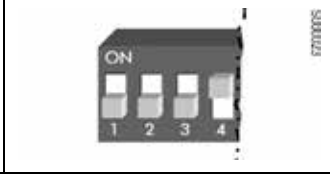
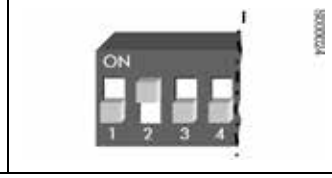
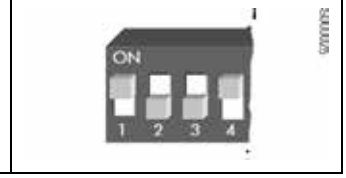
Configuration of ambient analogue channel 4			
Mode 0 ÷ 10 V f.s.	Mode 0 ÷ 100 mV f.s.	Mode 0 ÷ 20 mA f.s.	Temperature reading mode with PT100 thermal resistor
			

Table 22: DIP-switch for ambient analogue channel 4

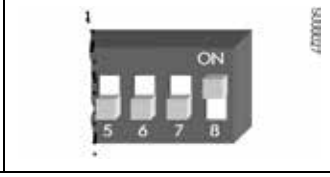
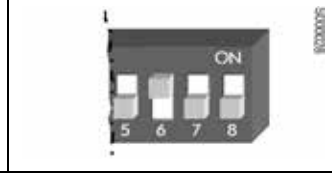
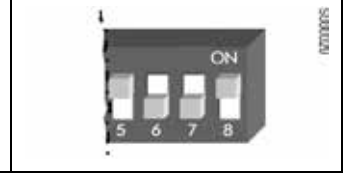
Configuration of ambient analogue channel 5			
Mode 0 ÷ 10 V f.s.	Mode 0 ÷ 100 mV f.s.	Mode 0 ÷ 20 mA f.s.	Temperature reading mode with PT100 thermal resistor
			

Table 23: DIP-switch for ambient analogue channel 5

SW2

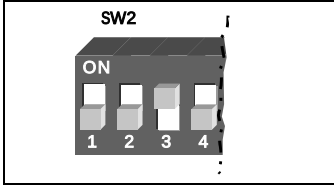
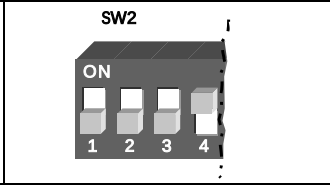
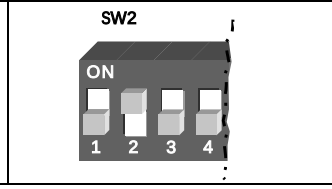
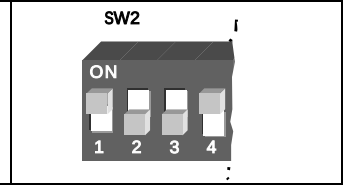
Configuration of ambient analogue channel 6			
Mode 0 ÷ 10 V f.s.	Mode 0 ÷ 100 mV f.s.	Mode 0 ÷ 20 mA f.s.	Temperature reading mode with PT100 thermal resistor
			

Table 24: DIP-switch for ambient analogue channel 6

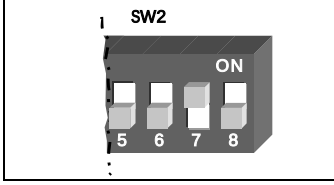
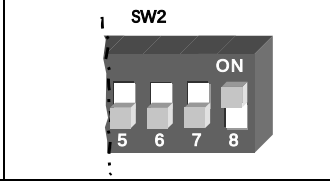
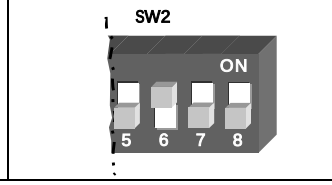
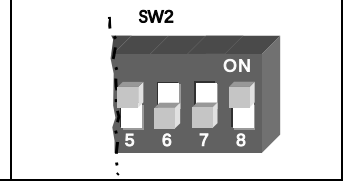
Configuration of ambient analogue channel 7			
Mode 0 ÷ 10 V f.s.	Mode 0 ÷ 100 mV f.s.	Mode 0 ÷ 20 mA f.s.	Temperature reading mode with PT100 thermal resistor
			

Table 25: DIP-switch for ambient analogue channel 7

The factory settings for the configuration DIP-switches are provided below:

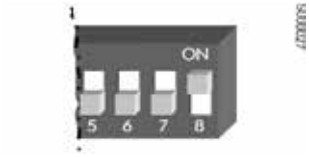
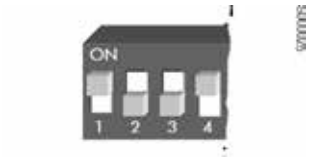
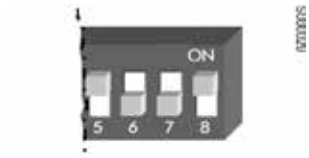
Factory Settings	
Ambient analogue channel 4	
Mode 0 ÷ 100 mV f.s.	
Ambient analogue channel 5	
Mode 0 ÷ 100 mV f.s.	
Ambient analogue channel 6	
Temperature reading mode with PT100 thermal resistor	
Ambient analogue channel 7	
Temperature reading mode with PT100 thermal resistor	

Table 26: DIP-switches for the configuration of the Ambient Sensors and Field I/Os Expansion Board

There are six software acquisition modes available (see section 5 PROGRAMMING) corresponding to the four hardware settings, as described in the table below.

Type of Acquisition Set by the Parameters	Mode Set on SW1 and SW2	Full-scale and Notes
Voltage 0 ÷ 10 V	Mode 0 ÷ 10 V f.s.	0 ÷ 10 V
Voltage 0 ÷ 100 mV	Mode 0 ÷ 100 mV f.s.	0 ÷ 100 mV
Current 0 ÷ 20 mA	Mode 0 ÷ 20 mA f.s.	0 mA ÷ 20 mA
Current 4 ÷ 20 mA	Mode 0 ÷ 20 mA f.s.	4 mA ÷ 20 mA
Temperature	Temperature reading mode with PT100 thermal resistor	-50 °C ÷ 125 °C.

Table 27: Hardware settings

CAUTION

Voltage-set inputs have a high input impedance and must always be closed when active. Interrupting the conductor connected to an analogue input set as a voltage input will not ensure that its channel reading will be equal to zero. Zero is read only if the input is wired to a low-impedance signal source or if it is short-circuited. Therefore, do not install relay contacts in series to the inputs to set the value reading to zero.

NOTE

The software parameter settings must be consistent with the DIP-switch settings. If the hardware configuration is not consistent with the type of acquisition set in the parameters, also the results will not be consistent with respect to the values acquired. Refer to the Programming Guide.

Any voltage or current value exceeding the max or min full-scale values will generate an acquired value limited to the max measure or the min measure respectively.

4.1.2. Analogue Inputs to Sensors with Voltage Output

It is recommended to connect the voltage source using a twisted pair screened cable and connecting its braiding on the expansion board side.

Although 'slow' acquisition analogue channels have a cut-off frequency slightly exceeding 10Hz and the grid frequency, which is the main disturbance source, is already weakened, make sure that wiring is correct, particularly if the full-scale value is 100mV and if wires are longer than 10 m.

Figure 49 and Figure 50: Connection to 0¸100mV analogue input, provide a wiring example for the acquisition of a voltage source.

The DIP-switches of the relevant analogue channels must be properly configured, by setting the full-scale value to 10V or to 100mV, according to the needs, and by setting the relevant programming parameter accordingly.

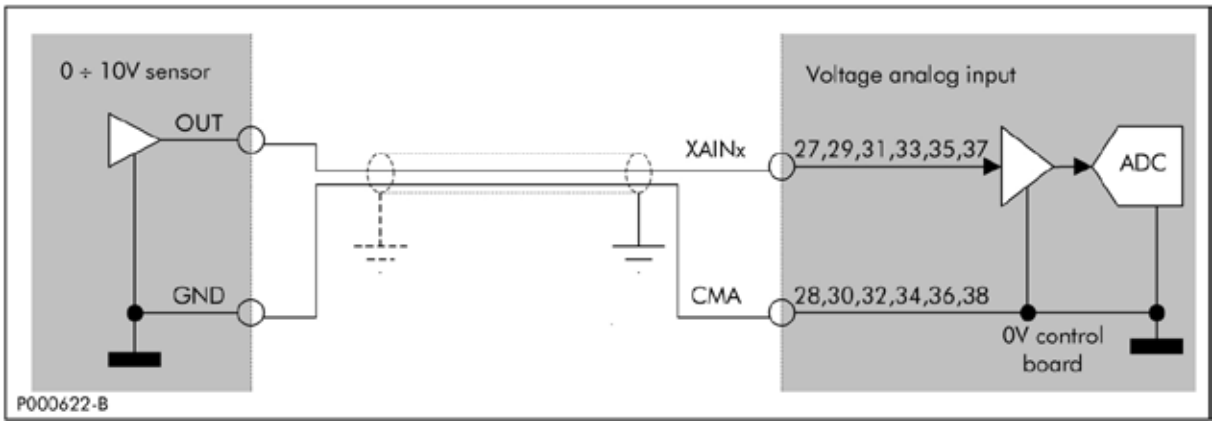


Figure 49: Connection to 0¸10V analogue input

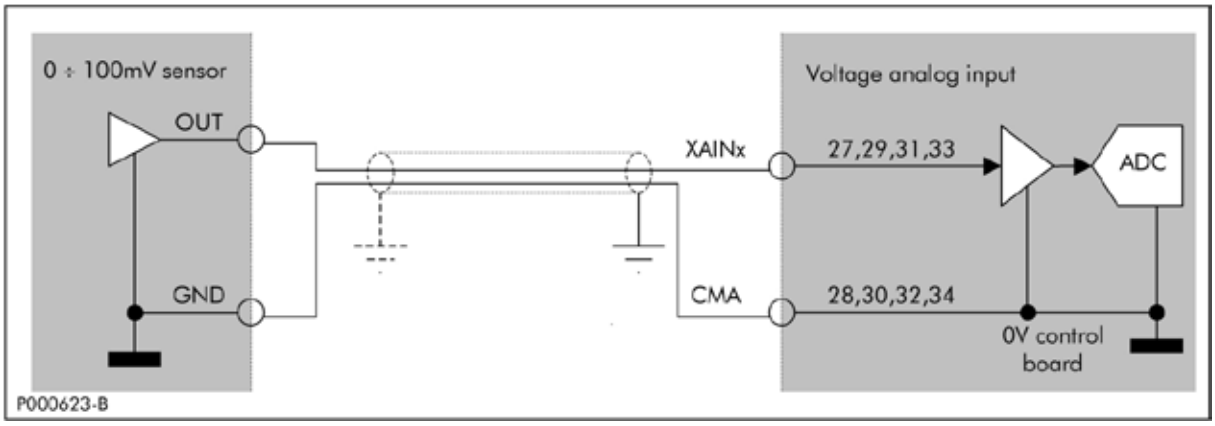


Figure 50: Connection to 0¸100mV analogue input

4.1.3. Analogue Inputs to Sensors with Current Output

The procedure on how to connect slow analogue inputs to current sources is shown in Figure 51: Wiring diagram for the connection of 0÷20 mA (4÷20mA) sensors to current inputs. Channels XAIN8, XAIN9, XAIN10 and XAIN11 – corresponding to terminals 27, 29, 31, 33 – are capable of acquiring current signals with a full-scale value of 20mA. Of course, the DIP-switches corresponding to the analogue channel being used must be configured accordingly, by setting the full-scale value to 20mA and by setting the relevant programming parameter at 0÷20mA or 4÷20mA.

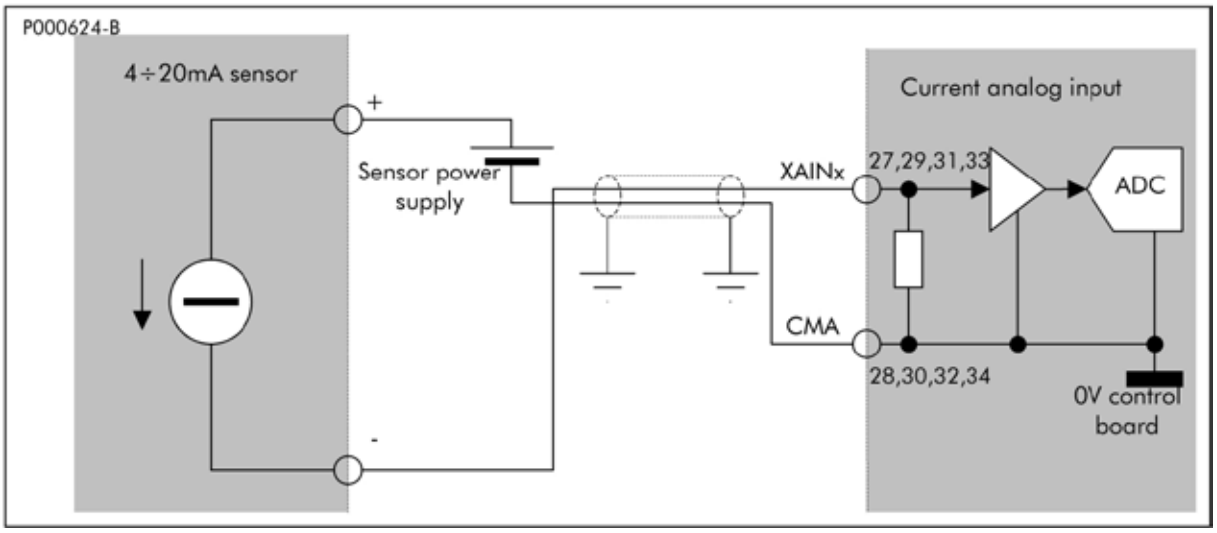


Figure 51: Wiring diagram for the connection of 0÷20 mA (4÷20mA) sensors to current inputs

4.1.4. Analogue Inputs to PT100 Thermal Resistors

The Ambient Signals and Field I/Os Expansion Board allows acquiring direct temperature measures by connecting to standard thermal resistors PT100. Two-wire connection is used for easier wiring. For this reason, it is recommended to limit the cable length and make sure that the cable is not exposed to considerable temperature variations during operation. The channels capable of acquiring the PT100 thermal resistors are XAIN8, XAIN9, XAIN10 and XAIN11 – corresponding to the terminals 27, 29, 31 and 33. The figure below shows the correct wiring method: it is recommended to use a screened cable and connect its braiding directly to the inverter metal case through the special conductor terminals.

If a cable longer than 10 metres is used, on-site measure calibration is required. For example, if a 1sqmm (AWG 17) screened twisted pair cable is used, this results in a reading error of approx. +1°C every 10 metres of cable length.

To perform measure calibration it is necessary to connect a PT100 sensor emulator – instead of the real sensor – set to 0°C (or a 100W 0.1% precision resistor) to the line terminals, and then rectify the relative offset value (see section Ambient Measures Expansion Menu P320 ÷ P354).

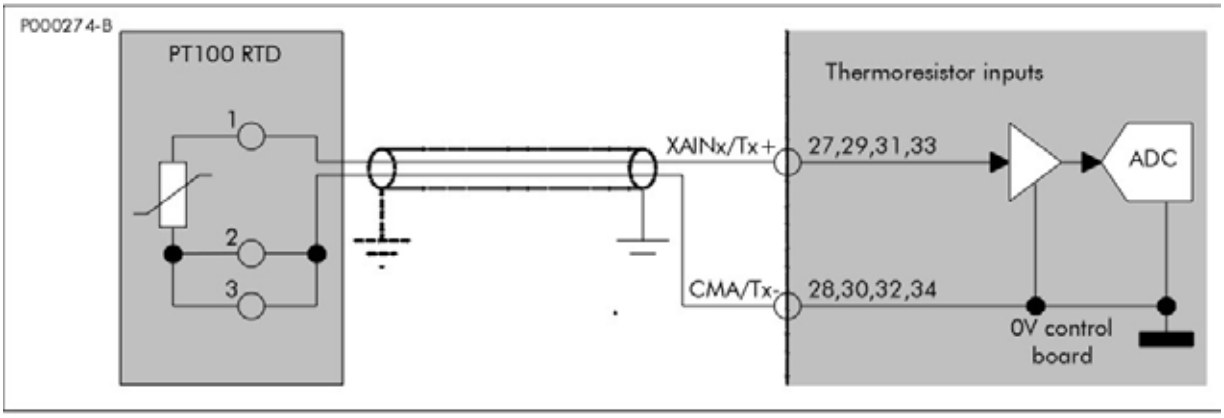


Figure 52: Wiring diagram for the connection of PT100 thermal resistors to analogue channels

4.1.5. External Pulse Counters for Energy Measurement

The Ambient Signals and Field I/Os Expansion Board allows connecting an external pulse counter to measure the energy fed into the grid. The wiring of this component is done through a free contact, as shown below.

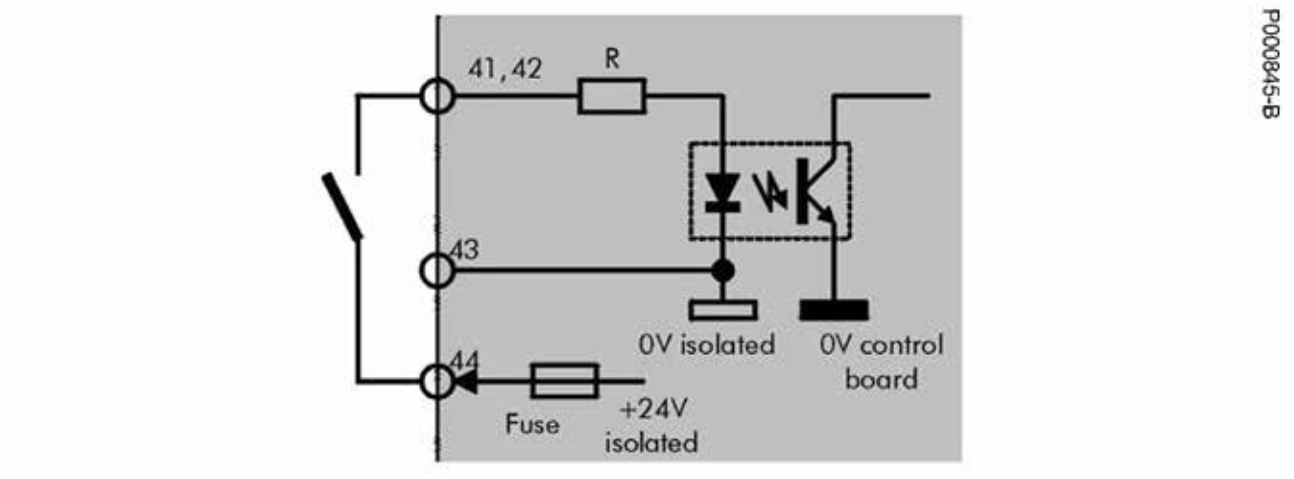


Figure 53: Wiring diagram for the connection of an energy counter through a free contact

Digital Input	Terminal for Ambient Signals and Field I/Os Expansion Board	Function
XMDI3	41	Energy pulse counter 1
XMDI4	42	Energy pulse counter 2

Table 28: Digital inputs for external counters

NOTE

The voltage levels to be used for the pulse counters are the following:

0V – Low level

24V – High level

Otherwise, use a free contact or a PNP contact and on-board +24V power supply.

The maximum input frequency for the auxiliary digital inputs is 40Hz.

The environmental and electrical specifications for the ambient signals and field I/Os expansion board are provided in section 7.10 Specifications of the Ambient Sensors and Field I/Os Expansion Board.

4.1.6. List of the Ambient Sensors Measures M110-M121

Parameter	Function	Access Level	Modbus Address
M110	Ambient measure 4	BASIC	1688
M111	Ambient measure 5	BASIC	1689
M112	Ambient measure 6	BASIC	1690
M113	Ambient measure 7	BASIC	1691
M114	Ambient measure 8	BASIC	1692
M115	Ambient measure 9	BASIC	1693
M116	Intermediate ambient measure 4	ADVANCED	1710
M117	Intermediate ambient measure 5	ADVANCED	1711
M118	Intermediate ambient measure 6	ADVANCED	1712
M119	Intermediate ambient measure 7	ADVANCED	1713
M120	Intermediate ambient measure 8	ADVANCED	1714
M121	Intermediate ambient measure 9	ADVANCED	1715

Table 29: List of the ambient sensors measures M110-M121

4.2. Additional Photovoltaic Field (PV2)

4.2.1. Description

The 'Additional Photovoltaic Field' (PV2) option allows connecting the SUNWAY M PLUS to an additional PV field having different electrical specifications with respect to the Main PV Field. A boost converter allows the two fields to simultaneously operate in MPPT mode. Also, the inverter can operate with the Additional PV Field (PV2) only, thus allowing a wider input voltage range at the inverter.

NOTE

To be ordered together with the inverter.

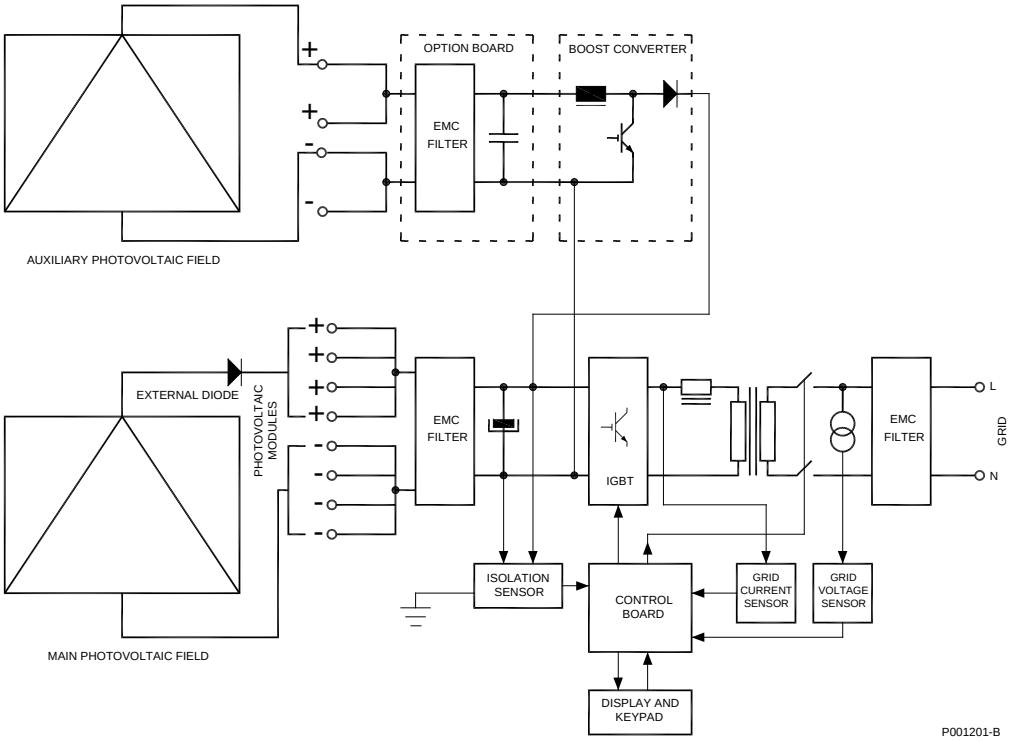


Figure 54: Basic wiring diagram with Additional PV Field option installed

The figure above shows the wiring diagram of the SUNWAY M PLUS with the Additional PV Field option installed. Its operating principle is the following: the boost converter transfers the power produced by the Additional Photovoltaic Field (PV2) via the DC-BUS, which delivers it to the grid along with the power produced by the Main PV Field.

A sophisticated control algorithm allows the MPPT function to operate for both PV fields.

CAUTION

The max rated voltage of the PV field must never be exceeded. A higher voltage will damage the equipment in an irreversible manner.

CAUTION

If both the Main and the Additional fields are installed, an anti-reversal diode must be installed on the FIELD. See 4.2.4 Selection and Installation of the Anti-Reversal Diode.

There are three configuration modes available for the PV fields connected to the inverter:

- Only the Main PV Field is installed (standard installation).
- Only the Additional PV Field (PV2) is installed on the secondary input.
- Both the Main and the Additional fields are installed.

4.2.2. Specifications of the Additional PV Field (PV2)

For information on the voltage and max power, refer to Table 94: Additional PV field specifications.

For the dimensioning, refer to section 4.2.5 Configuration with both the Main and the Additional PV Field.

NOTE

The equipment can operate with the Additional PV Field only. To ensure continuity of operation below the powering on thresholds, it is necessary to install the auxiliary power supply option.

The Additional PV Field option cannot be installed on the SUNWAY M PLUS 1300E.

4.2.3. Connection of the Additional PV Field (PV2)

The SUNWAY M PLUS can connect on the Additional PV Field (PV2) input up to two strings in parallel without the need to install any additional components**.**

After wiring the grid and the Main Photovoltaic Field, it is possible to wire the Additional PV Field (PV2) (if ordered with the inverter). The same instructions for the connection of the Main PV Field apply. Refer to section 2.6.3 Connection of the PV Field Cables (DC).

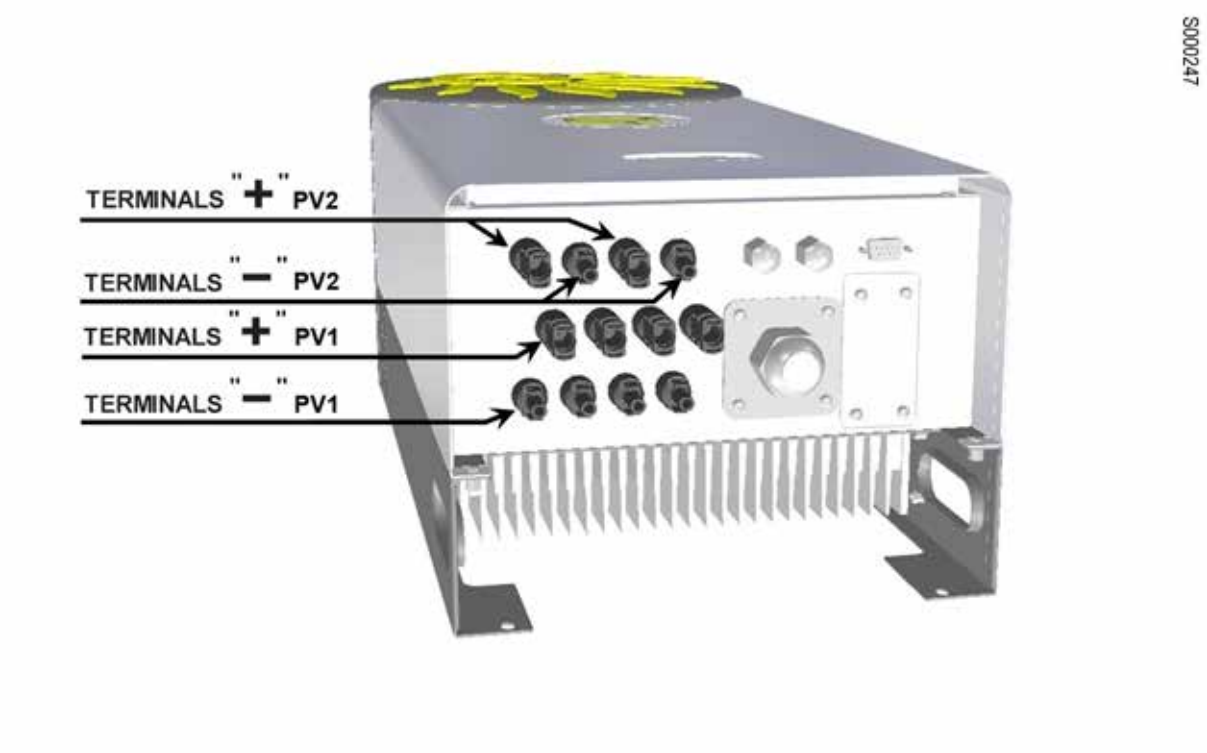


Figure 55: String polarity of the Additional PV Field.

4.2.4. Selection and Installation of the Anti-Reversal Diode

In the configuration with both the Main and the Additional fields, **a diode should be provided at the end of the string** and external to the inverter, connected in series with the positive pole of the main field, to prevent the flow of reverse current to the main field in the event that only the Additional PV Field is hit by solar radiations.

The diode must have the following specifications:

- Min reverse voltage 1200 Vdc.
- Current carrying capacity equal to twice the maximum input current of the inverter (see Table 85: Input/output electrical specifications).

Moreover, a proper dispersion system should be provided to dissipate the heat produced by the diode, according to the Manufacturer's specifications.

4.2.5. Configuration with both the Main and the Additional PV Field

The operating ranges for the MPPTs of the Main and Additional fields are shown in the figure below:

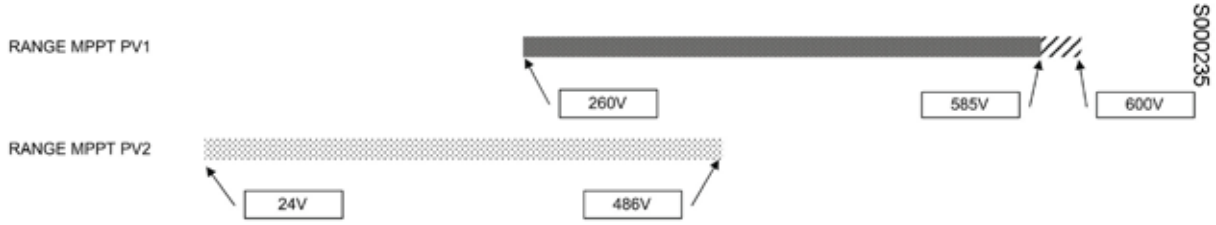


Figure 56: Independent Vmpp ranges of the Main and Additional PV fields

In the configuration with two PV fields, the main and additional fields operate with two independent MPPTs, but it must be considered that their Vmpp ranges are interlocked.

Therefore, the strings connected to the second MPPT are to be configured with **a number of modules in series lower** than those of the main field.

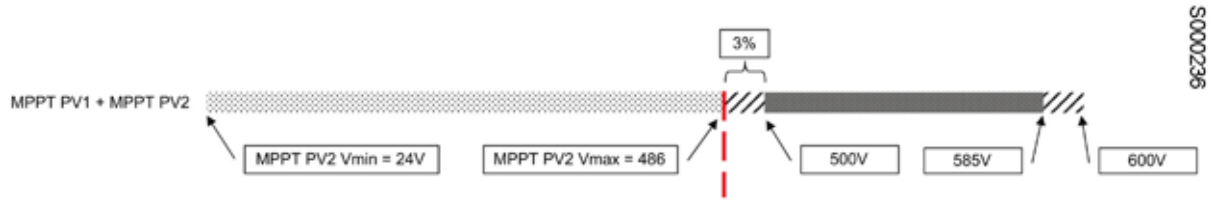


Figure 57: Interlocked Vmpp ranges of the Main and Additional PV fields

The main parameter for the configuration of the two fields is P307. As a matter of facts, the Vmpp range of the secondary field varies between the minimum corresponding to P306, and the maximum corresponding to P307, while the range of the main field varies between P307 * 1.03 and 585 V. To resume:

- Vmpp range of the additional field (PV2): P306 ÷ P307.
- Vmpp range of the main field (PV1): (P307 x 1.03) ÷ 585V.

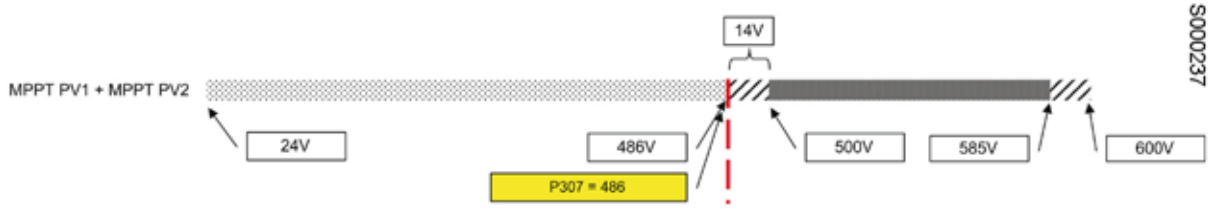


Figure 58: Configuration parameter P307

For example, if P307 = 250 V (see following figure), the main MPPT range is:

- Vmp main field (PV1): 257 V ÷ 585 V.
- Vmp additional field (PV2): 24 V ÷ 250 V.

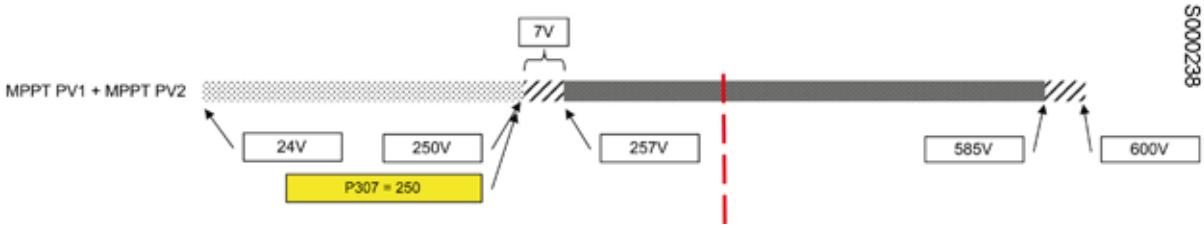


Figure 59: Example with P307 = 250V

Configuration example, Case 1

A 3400W-peak plant is taken as example, equipped with SUNWAY M PLUS 3600, where the PV generator consists of (17x) 200W modules.

The selected modules have a min Vmpp of 35 V, and a max Vmpp of 43.3 V, within the temperature range foreseen for operation.

Considering a string on the main field composed of 10 modules, and a string on the additional field of 7 modules, the following results:

- Vmp main field (PV1): min voltage 350 V, max voltage 433 V.
- Vmp additional field (PV2): min voltage 245 V, max voltage 303 V.

Considering P307 = 310 V à OK

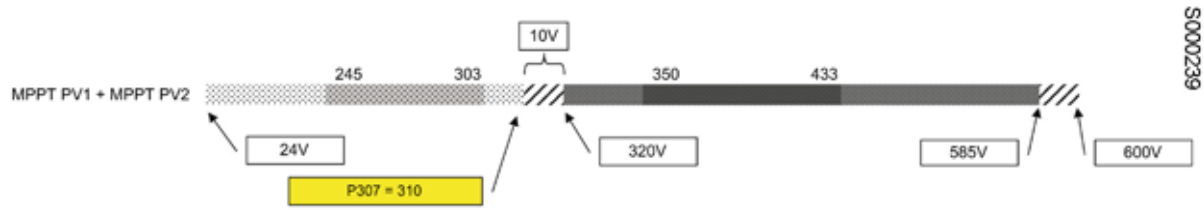


Figure 60: Example with P307 = 310V

Configuration example, Case 2:

A 9-module string on the main field and an 8-module string on the additional field are taken as example.

- Vmp main field (PV1): min voltage 315 V and max voltage 389.7 V.
- Vmp additional field (PV2): min voltage 280 V and max voltage 346.4 V.

The two Vmpp ranges overlap, therefore joint configuration is not recommended.

Refer to section 5 PROGRAMMING.

4.3. Auxiliary Power Supply

The internal circuits of the SUNWAY M PLUS are powered directly by the photovoltaic field. As a consequence, when solar radiation is too weak, the control circuit is not powered.

However, under certain circumstances it may be necessary to have the equipment always powered on, as when:

- The equipment is linked to a remote system and remote communication is required at any moment.
- The inverter is part of a communication system with a local PC and a LED info panel.
- The inverter is powered only by the additional PV field (PV2).

NOTE

The equipment can operate with the Additional PV Field only. To ensure continuity of operation below the powering on thresholds, it is necessary to install the auxiliary power supply option.

The Additional PV Field option cannot be installed on the SUNWAY M PLUS 1300E.

The auxiliary power supply option is fitted on the rear side of the Sunway.

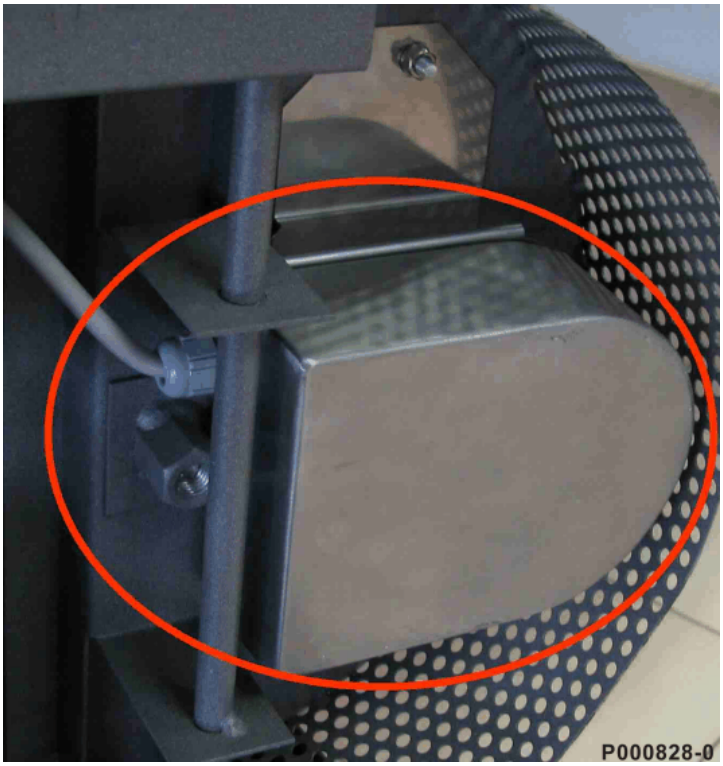


Figure 61: View of an inverter fitted with the auxiliary power supply option

NOTE

To be ordered together with the inverter.

4.4. Data Logger

The Data Logger board is available as an option. This board acts as a telecommunication unit and allows implementing several functions: local storage of the production data, inverter-to-inverter interconnection and inverter-to-Smart String Box connection under the Santerno remote monitoring system.

Figure 62: Optional Data Logger board

NOTE

To be ordered together with the inverter.

The Data Logger board is installed on the control board of the inverter.

Figure 63: Location of the optional Data Logger board

Each Data Logger board is capable of monitoring up to 15 devices (single-phase/three-phase inverters and any auxiliary sensors) connected in multidrop configuration via the RS485 bus. The Data Logger acts as the Modbus Master on the bus, while all the other devices operate as Modbus Slaves.

For further information see the Programming Guide for the Data Logger.

The Data Logger board has two serial ports and an Ethernet port:

- COM1, COM2, serial ports RS485 Modbus/RTU.
- Ethernet.

4.4.1. Local and Remote Connectivity

The exchange of data and information with the Data Logger board or with the devices it controls can be carried out through the two serial ports COM1 and COM2, through the Ethernet port for LAN and Internet connection, or through the connection to a GPRS modem/router.

The Data Logger board can be connected to a PC in two ways:

- Locally: through the COM1 and COM2 serial ports (RS232 or RS485), or through the Ethernet port for direct LAN connection.
- Remotely: through the Ethernet port or through a GPRS modem/router, both connected over the Internet or through point-to-point connections.

4.4.2. Connection

The communication ports for the Data Logger board are shown in Figure 64.

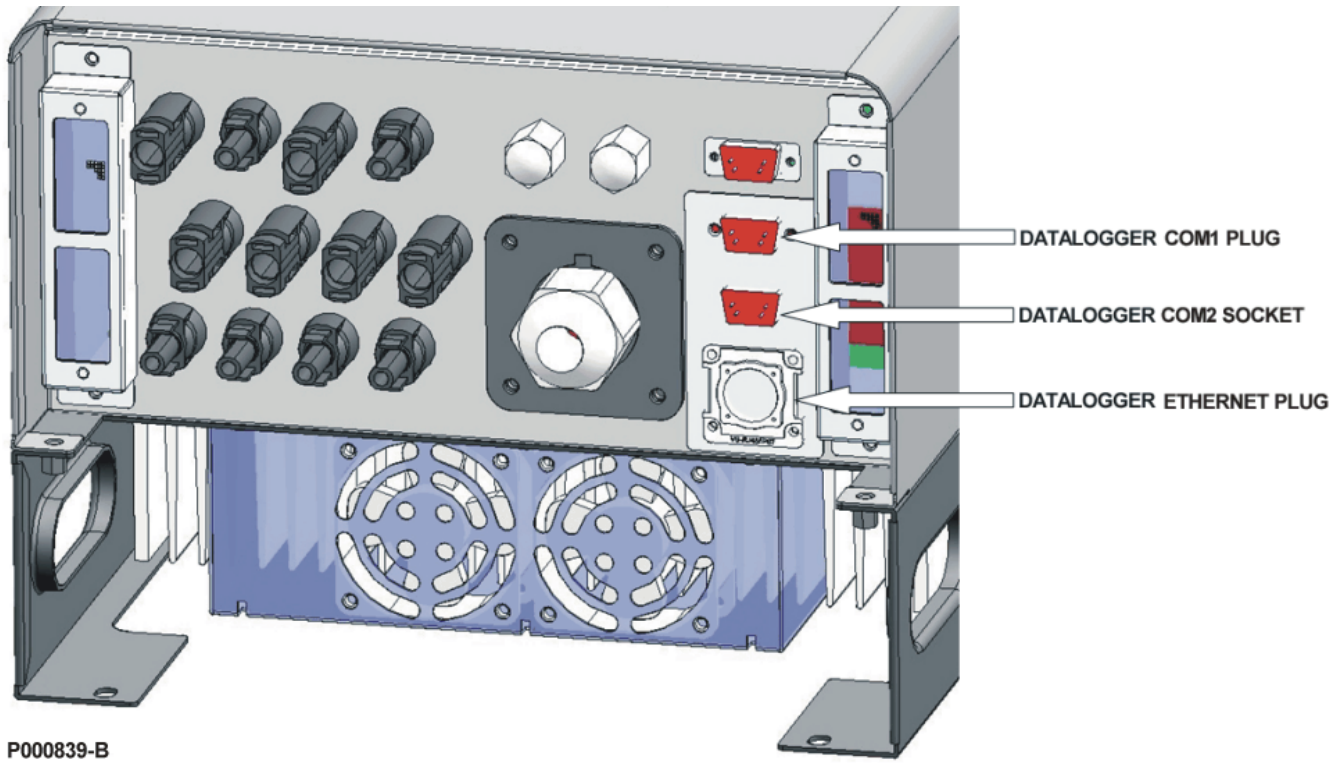


Figure 64: Location of the communication ports of the Data Logger board

CAUTION

The wiring of the module is to be carried out with the inverter powered OFF. Always take all the necessary precautions before accessing the connectors.

The Data Logger board offers the following communication ports:

Port Name	Description	Connection
COM1 RS232	Modem/PC Connection	DB9 – Male
COM1 RS485	Remote Control System – Slave Connection	DB9 – Male
COM2 RS485	Remote Control System – Master Connection	DB9 - Female
Ethernet	Ethernet Connection	RJ45

Table 30: Communication ports available on the Data Logger board

NOTE

COM1 RS232 is an alternative to COM1 RS485. Factory setting is COM1 RS232.

The operating modes (Master or Slave) of the COM ports can be changed, if necessary, by setting some parameters for the configuration of the Data Logger board accordingly (refer to the Programming Guide of the Data Logger board). The preset configuration is stated in the table above.

Modem connection is an alternative to Ethernet connection. The Data Logger board CANNOT support both of them.

4.4.2.1. Types of RS232 Connections

Port COM1 is factory-set for an RS232 connection. RS232 connection is needed for some of the communication options available on the Data Logger board:

- Direct connection to a PC through a null modem cable (Modbus RTU protocol in Slave mode);
- Connection via analogue/digital modem to a remote PC.

For modem connections, the DB9 connector is connected to the computer through a RS232 cable (cross-over cable).

For connections via analogue modem, the DB9 connector is connected to the modem through an RS232 cable not crossed-over.

For connections via digital modem, see section 4.5 GPRS Modem/Router.

See Table 83: Specifications of the Serial Link RS232.

4.4.2.2. Types of RS485 Connections

RS485 connection is needed for some of the communication options available on the Data Logger board:

- Direct connection to a PC with a properly wired cable and an RS485/USB or RS485/RS232 converter (Modbus RTU protocol in Slave mode).
- Direct connection to the multidrop network of the plant devices (Modbus RTU in Master mode).

Port COM2 is factory-set for an RS485 connection in Master mode. Port COM1 of the board may also be converted into an RS485 port in Slave mode; this request must be stated when ordering the equipment. Refer to section 3.2.4.1 General Principles of the RS485 Bus.

It is important to note that the network composed of the termination resistor and the polarization resistors is incorporated into the inverter for convenience of use, and can be inserted through the DIP-switches. Figure 34: Recommended Modbus wiring diagram for '2-wire' devices shows the termination diagram only for the devices at the ends of the chain, since the terminator is to be enabled only at them.

For the connection to a multidrop network, up to 128 devices can be connected (as shown in Figure 65). Make sure that the ID of each device is properly preset (see the Programming Guide of the Data Logger board).

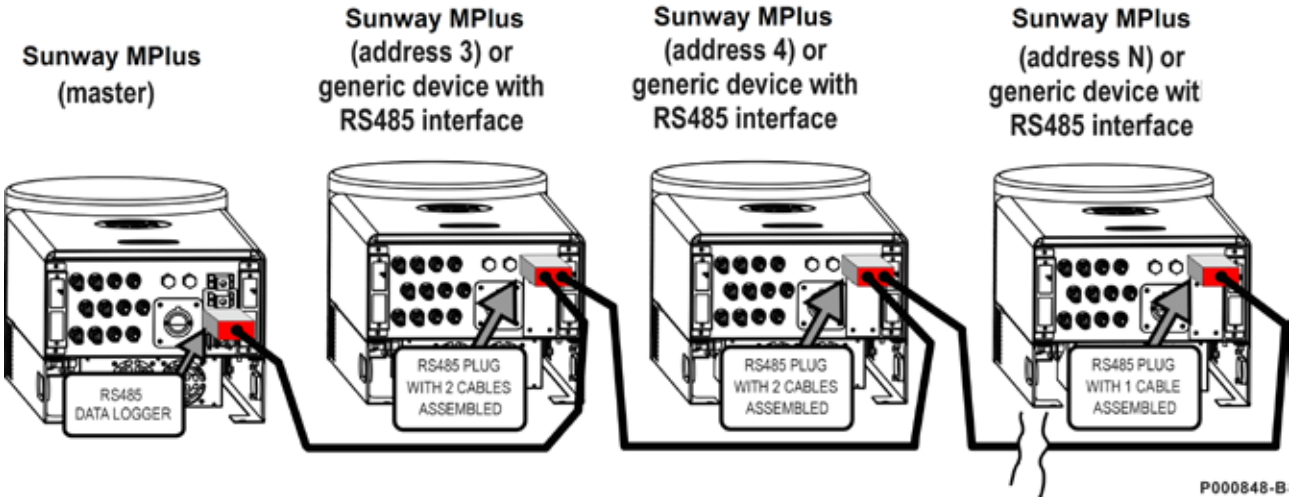

Sunway MPlus (master)
Sunway MPlus (address 3) or generic device with RS485 interface
Sunway MPlus (address 4) or generic device with RS485 interface
Sunway MPlus (address N) or generic device wit RS485 interface
RS485 DATA LOGGER
RS485 PLUG WITH 2 CABLES ASSEMBLED
RS485 PLUG WITH 2 CABLES ASSEMBLED
RS485 PLUG WITH 1 CABLE ASSEMBLED
P000848-B

Figure 65: Multidrop connection through RS485 connector

NOTE

The generic device in Figure 65 can be a SUNWAY M PLUS inverter, an ambient sensor (DATEXEL 3017 or 3148) or a string box (CS-SP).

It is advisable that all the devices connected to the communication multidrop network be wired sharing their common conductor (0V), to minimize any difference of ground potentials between devices, which may adversely affect communications.

Multidrop line RS485 connecting to multiple devices must be wired using a linear wiring (not a star wiring): each device connected to the line has to be reached by the cable coming from the preceding device, and be connected to the device coming next on the line. For this purpose, two pins for each line signal are provided on the inverter connector. The incoming line can be connected to pins 1 and 2, whereas the outgoing line can be connected to pins 3 and 4.

Obviously, the first device in the multidrop chain will have only one outgoing line, while the last device will have only one incoming line. Therefore, the line terminator is to be installed on the first device and the last device.

In the most frequent case, where the line Master is installed on one end of the line, the device installed at the farthest point must have the line terminator enabled. See Table 82: Specifications of the Serial Link RS485.

NOTE

Communication does not take place or is adversely affected if multidrop terminators are not properly set, especially in case of a high baud rate. If more than two terminators are fitted on a line, some drivers can enter the protection mode due to overheating, thus cutting off the communication of some of the connected devices.

4.4.2.3. Configuration and Wiring of Port COM1

To interface with port COM1 (see Figure 64) of the Data Logger board, the SUNWAY M PLUS is equipped with a DB9 connector. Port COM1 has two possible operating modes to be set in the factory:

- RS232 Modbus RTU (default).
- RS485 Modbus RTU.

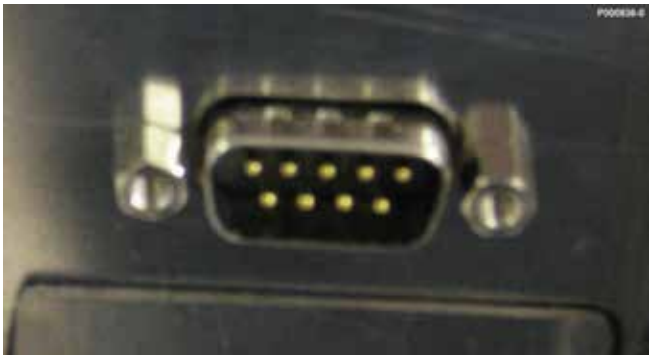


Figure 66: DB9 connector, RS232 port

- Configuration and wiring of the RS232 Modbus RTU mode.

The pin scheme for the connector shown in Figure 66 is as follows:

Pin	Name	Function
-	Shield	Connector frame connected to the PE
1	CD	Carrier Detect
2	RD	Received Data
3	TD	Transmitted Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

Table 31: List of the pins on the DB9 connector – Port COM1 RS232

The DB9 connector of port COM1 is located on the panel in the lower part of the inverter (see Figure 64). To connect to it, just remove the protective cap of the RS232 connector and connect the cable fitted with the female DB9 connector (wired as per Table 31) to the male connector on the inverter (see Figure 66).

The metal case of the DB9 connector is connected to the inverter ground point. Connect the braiding of the twisted pair cable for the serial link to the metal case of the male connector to be connected to the inverter.

· Configuration and wiring of the RS485 Modbus RTU mode.

CAUTION

This mode is not the inverter default mode. Therefore, if needed, it must be specified when ordering the inverter.

On port COM1, the RS485 mode is an ALTERNATIVE to the RS232 mode. The two modes cannot be used at the same time.

The pin scheme for the connector shown in Figure 66 is as follows:

Pin	Name	Function
1 – 3	A-Line	(TX/RX A) Differential input/output A (bidirectional) complying with the RS485 standard. Positive polarity with respect to pins 2 – 4 for one MARK.
2 – 4	B-Line	(TX/RX B) Differential input/output B (bidirectional) complying with the RS485 standard. Negative polarity with respect to pins 1 – 3 for one MARK.
5	GND	(0V) zero volt, control board
6	N.C.	Not connected
7-8	GND	(GND) zero volt, control board
9	+5V	+5 V, max 100 mA for the supply of the external RS-485/RS-232 converter (option)

Table 32: List of the pins on the DB9 connector – Port COM1 RS485

The DB9 connector of port COM1 is located on the panel in the lower part of the inverter (see Figure 64). To connect to it, just remove the protective cap of the RS485 connector and connect the cable fitted with the female DB9 connector (wired as per Table 32) to the male connector on the inverter (see Figure 66).

The metal case of the DB9 connector is connected to the inverter ground point. Connect the braiding of the twisted pair cable for the serial link to the metal case of the male connector to be connected to the inverter.

NOTE

Port COM1 in RS485 mode is equipped with the configuration DIP-switches used to enable the line terminators. The terminators are not accessible directly for the user, since they are located only on the Data Logger board. Under factory setting the terminators are NOT enabled.

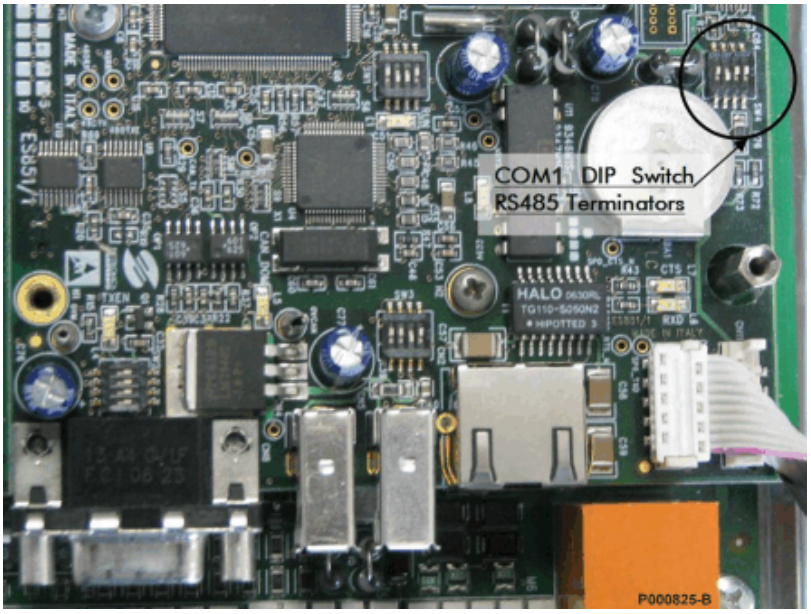


Figure 67: COM1 line terminator

To access the SW4 DIP-switch to enable the line terminators for the RS485 link on port COM1, it is necessary to open the inverter. To do so, follow the procedure described in section 3.1 Accessing the Inverter.

DANGER

Before accessing the inverter, cut-off the power supply and wait at least 10 minutes. There is a risk of electric shock even when the inverter is not powered, until the capacitors are fully discharged.

CAUTION

Do not connect/disconnect the signal terminals or the power terminals when the inverter is powered, such operation entailing the risk of electric shock and damage to the inverter.

NOTE

When wiring the inverter, the user is allowed to remove only the screws mentioned in these installation instructions. Removing other screws or bolts will void the inverter warranty.

The following table provides the DIP-switch factory settings.

DIP-switch	Function	Factory Setting
SW4-3 SW4-4	RS485 COM1 termination	**Both ON**: RS485 terminator enabled

Table 33: Description of the functions provided for by the RS485 – COM1 DIP-switches

4.4.2.4. Configuration and Wiring of Port COM2

To interface with port COM2 of the Data Logger board, the SUNWAY M PLUS is fitted with a DB9 connector. Port COM2 is a RS485 Modbus RTU port and is factory-set to Master mode.

Figure 68: DB9 connector, port COM2

The pin scheme is described in the following table:

Pin	Name	Function
-	Shield	Connector frame connected to the PE
1	N.C.	
2	N.C.	
3	A-Line	Positive RxD/TxD according to RS485 specifications
4	PB_RTS	Request To Send – active high during transmission
5	GND	(0 V) zero volt of the bus isolated with respect to the 0V of the control board
6	+5V	Driver bus power supply isolated with respect to the circuits of the control board
7	N.C.	
8	B-Line	Negative RxD/TxD according to RS485 specifications
9	N.C.	

Table 34: List of the pins on the DB9 – COM2 connector

The DB9 connector of port COM2 is located on the panel in the lower part of the inverter (see Figure 64). To connect to it, just remove the protective cap of the RS485 connector and connect the cable fitted with the male DB9 connector (wired as per Table 34) to the female connector on the inverter (see Figure 68).

The metal case of the DB9 connector is connected to the inverter ground point. Connect the braiding of the twisted pair cable for the serial link to the metal case of the male connector to be connected to the inverter.

NOTE

Port COM2 is equipped with the configuration DIP-switches used to enable the line terminators. The terminators are not accessible directly for the user, since they are located only on the Data Logger board.

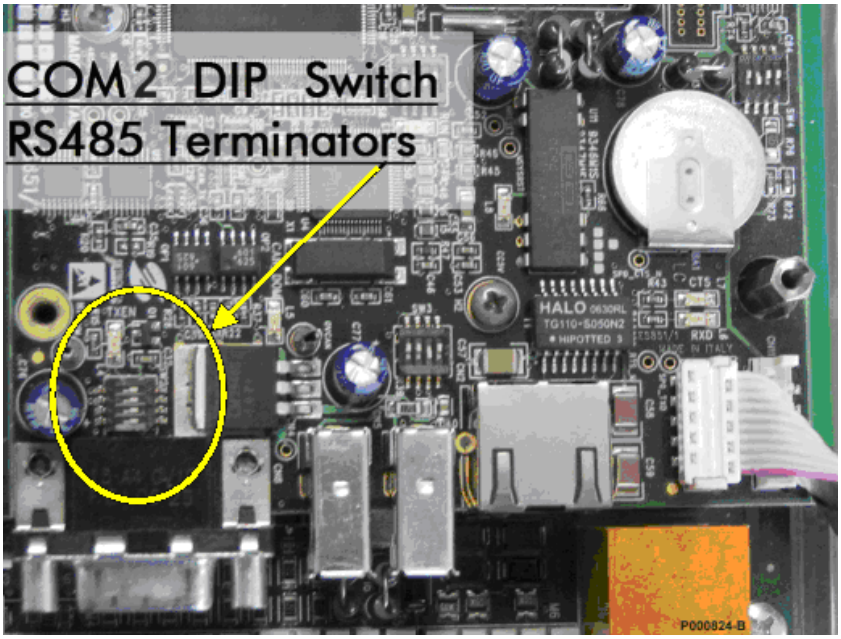


Figure 69: COM2 line terminator

To access the SW4 DIP-switch to enable the line terminators for the RS485 link on port COM2, it is necessary to open the inverter. To do so, follow the procedure described in section 3.1 Accessing the Inverter.

DANGER

Before accessing the inverter, cut-off the power supply and wait at least 10 minutes. There is a risk of electric shock even when the inverter is not powered, until the capacitors are fully discharged.

CAUTION

Do not connect/disconnect the signal terminals or the power terminals when the inverter is powered, such operation entailing the risk of electric shock and damage to the inverter.

NOTE

When wiring the inverter, the user is allowed to remove only the screws mentioned in these installation instructions. Removing other screws or bolts will void the inverter warranty.

The following table provides the DIP-switch factory settings.

DIP-switch	Function	Factory Settings
SW2-3 SW2-4	RS485 COM2 termination	Both ON: terminators enabled

Table 35: Description of the functions provided for by the RS485 – COM2 DIP-switches

4.4.2.5. Ethernet Connection

The Data Logger board is fitted with an RJ45 standard connector (IEEE 802) for the Ethernet connection 10/100 (100Base-TX, 10Base-T).

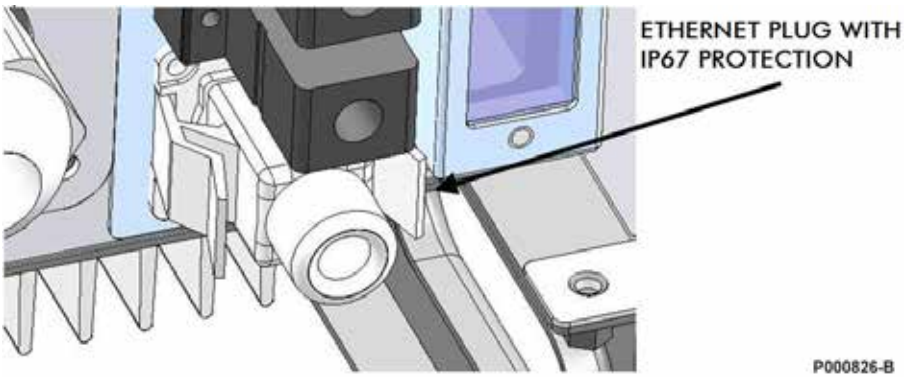


Figure 70: Ethernet connector

The Ethernet connection follows the RJ45 standard using a connector with IP67 protection degree.

The pin scheme for the connector is as follows:

No.	Name	Description
1	TD+	Positive signal transmission line
2	TD-	Negative signal transmission line
3	RD+	Positive signal receiving line
4	Term	Unused terminated pair
5	Term	Unused terminated pair
6	RD-	Negative signal receiving line
7	Term	Unused terminated pair
8	Term	Unused terminated pair

Table 36: Description of the pins on the Ethernet connector

The Data Logger board can be connected, through the Ethernet interface, to an Ethernet control device in one of the following ways:

- **Connection through a LAN network** (e.g. the company's Ethernet network).
- **Connection through a router** (e.g. ISDN, ADSL, GPRS) (only from the SW version DL166X of the Data Logger board).
- Direct point-to-point connection.

CAUTION

Connection through a router is available only if the LINK service for the connection to the Internet has been purchased.

Connection through a LAN network

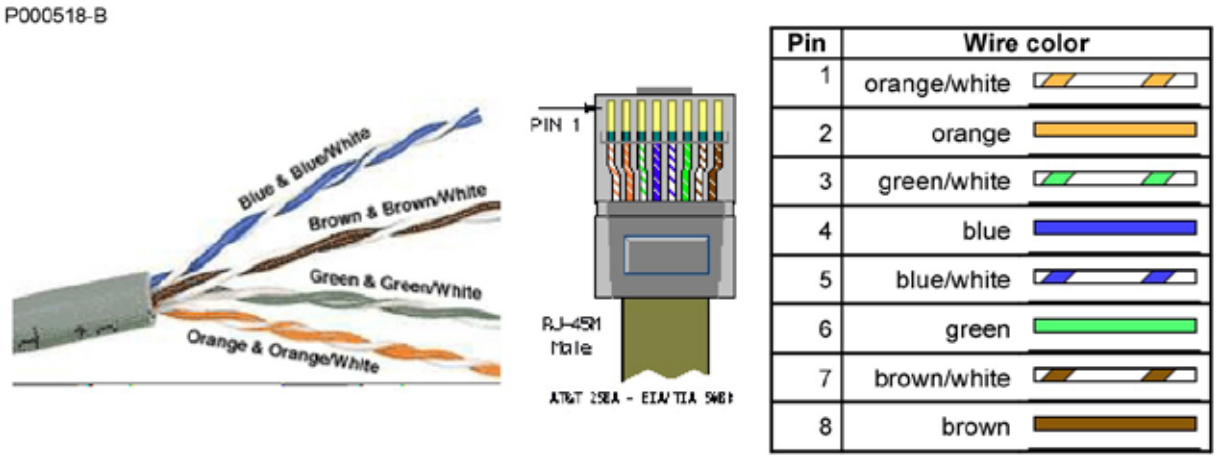
If the LINK service for the connection to the Internet was purchased, the Data Logger board is factory-set to allow connecting it to the Internet through a LAN network. To do so, simply connect the board via a standard straight-through cable TIA/EIA-568-B of class 5 UTP (Patch cable for LAN, see Figure 71). Under such connection, the plant can be accessed from any remote PC connected to the Internet.

CAUTION

In the case described above, the DHCP and DNS functions must be available for the LAN. Also, the LAN must be connected to the Internet.

NOTE

The Ethernet interface board cannot be connected to old LANs using Thin Ethernet (10base2) coaxial cables. Connection to this type of LANs is only possible using a Hub provided with both Thin Ethernet (10base2) connectors and 100Base-TX or 10Base-T connectors. The LAN topology is a star one, with each node connected to the Hub or the Switch through its own cable.



Pin	Wire color
1	orange/white
2	orange
3	green/white
4	blue
5	blue/white
6	green
7	brown/white
8	brown

Figure 71: Ethernet Class 5 cable and standard layout of the cable colours in the connector

If the option for the connection to the Internet (LINK service) was not purchased, the Data Logger board can still be connected to the LAN network to allow for the remote detection of the board and the plant, but ONLY within the said LAN network, and after programming the board parameters accordingly. Please refer to the Data Logger Programming Guide.

Connection through a router

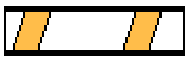
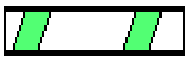
If the LINK service for the connection to the Internet was purchased, the Data Logger board is factory-set to allow for the direct connection to the Internet simply by connecting the board to the router using the cable provided with the router.

Point-to-Point Connection

A special software programming is required for the point-to-point connection. Please refer to the Data Logger Programming Guide.

Direct point-to-point connection is obtained with a Cross-Over Cable TIA/EIA-568-B, class 5. This type of cable performs a cross-over of the pairs so to have the TD+/TD- pair on one side corresponding to the RD+/RD- pair on the other side, and vice versa.

The table below shows the colour matching on the connector pins for the Cross-Over Cable and the cross-over scheme of the two pairs used in the 100Base-TX or 10Base-T connection.

Pin and Wire Colour (Cable Start)				Pin and Wire Colour (Cable End)		
1	white/orange			1	white/green	
2	orange			2	green	
3	white/green			3	white/orange	
4	blue			4	white/brown	
5	white/blue			5	brown	
6	green			6	orange	
7	white/brown			7	blue	
8	brown			8	white/blue	

NOTE

To avoid propagating disturbances to the Ethernet cables, they must be segregated and kept as far as possible from any other power cables and signal cables of the inverter. Disturbance propagation to the Ethernet cables may affect the correct operation of the inverter and of the other devices (PCs, PLCs, Switches, Routers) connected to the same LAN.

The maximum length of the LAN cable, class 5 UTP allowed by the IEEE 802 standards results from the max transit time allowed by the protocol and is equal to 100 m. The longer the cable length, the higher the risk of communications failure.

For Ethernet wiring, only use cables certified for LAN of 5 UTP class or higher. If there are no particular needs concerning the cable length or other wiring variables, users should not assemble the cables on their own. Always use Straight-Through and Cross-Over cables purchased from an IT dealer.

For a proper configuration and utilisation of the board, the user should have a basic knowledge of the TCP/IP protocol and should get familiar with the concepts of MAC address, IP address and ARP (Address Resolution Protocol). The relevant reference document available on the Internet is the RFC1180 – "A TCP/IP Tutorial".

4.5. GPRS Modem/Router

NOTE

This option is only available with the Data Logger option.

The GPRS module, via an Internet connection, allows the user to remotely monitor the status of the inverter, access the production data and receive messages in case of malfunctions. The services provided allow the user to take prompt action on the plant or simply to work remotely to change the parameters of the inverter.

CAUTION

Because environmental conditions strongly affect the expected life of the GPRS module, only install indoors and protected against weather conditions.

4.6. Positive Earth

This option is needed if the photovoltaic panels connected to the inverter require ground polarisation of the positive pole of the PV field. Check with your supplier of PV panels the configuration of the PV field and the grounding of the PV panel frames.

NOTE

To be ordered together with the inverter.

4.7. Negative Earth

This option is needed if the photovoltaic panels connected to the inverter require ground polarisation of the negative pole of the PV field. Check with your supplier of PV panels the correct wiring of the inverter to the PV field.

NOTE

To be ordered together with the inverter.

5. PROGRAMMING

The inverter is supplied already programmed and no parameter modification is generally required.

However, two programming levels are available, which can be modified through parameter P001:

The **BASIC** level (factory setting) allows viewing the main measures and allows editing parameters P001 (programming level) and P263 (Language).

The **ADVANCED** level allows accessing all programming parameters.

NOTE

To program the inverter, the Advanced programming level must be selected.

5.1. Menu Structure for Measures and Parameters

This Programming Guide follows the Menu structure as it is displayed both on the display/keypad and on the Remote Sunway.

The equipment displays read-only measures in the measures menus, while it allows customizing the equipment operation through the editing of the parameters.

The measures grouped in the 'MEA' menu are only available for displaying (read-only) and are identified by an M followed by 3 figures.

Parameters, on the contrary, can be customized and are identified as P, C, I and R, followed by 3 figures.

5.1.1. Measures

The measures cannot be modified, since they only represent the variables processed by the system. The table below specifies the information provided for the measures described in this manual.

Mxxx	**Range**	Internal representation	Value displayed on the display/keypad and the Remote Sunway (may be a decimal figure) plus unit of measure.
	Active	If present, this field indicates if and when the measure is valid. When this field is not present, the measure concerned is considered as ALWAYS valid.	
	Address	Modbus address from which the measure is read (integer).	
	Level	Access level (BASIC / ADVANCED)	
	Function	Description of the measure	

5.1.2. Parameters

The parameters allow changing the operating behaviour of the equipment according to the user's special needs. Their values can be changed and stored. The table below specifies the information provided for the parameters described in this manual.

Pxxx	**Range**	Equipment internal representation (integer)	Value displayed on the display/keypad and the Remote Sunway (may be a decimal figure) plus unit of measure.
Name of the Parameter	**Default**	Factory setting of the parameter (as represented internally).	Factory setting of the parameter (as displayed) plus unit of measure.
	Level	Access level (BASIC / ADVANCED)	
	Active	If present, this field indicates if and when the parameter is active and modifiable. When this field is not present, the parameter concerned is considered as ALWAYS active.	
	Address	Modbus address from which the measure is read or to which it is written (integer).	
	Function	Description of the parameter.	

The parameter codes are marked by P, C, R or I.

NOTE

Parameters Pxxx: *Always accessible both in read and write mode.*

Parameters Cxxx: *Available in read mode only when the inverter is in RUN mode; available in read/write mode when the inverter is in STOP.*

Parameters Rxxx: *Always available in read/write mode but, unlike parameters Pxxx and Cxxx, they apply only upon restarting the equipment.*

Inputs Ixxx: *Always available in read/write mode but their value is not stored to the non-volatile memory, so that upon restarting their value is always 0.*

When a parameter is modified through the display/keypad, the new value may apply immediately (flashing cursor) or only upon quitting the programming mode (fixed cursor).

Typically, numeric parameters immediately come into effect, while alphanumeric parameters come into effect only upon quitting the programming mode.

Any change to a parameter using the Remote Sunway software is immediately implemented by the inverter.

5.1.3. Menu Structure and Navigation Procedures for the Display/Keypad

I	N	V	E	R	T	E	R		I	N		S	T	O	P
V	m	n					=			2	3	1	.	0	V
V	f	i	e	l	d		=			3	5	6	.	4	V
[	M	E	A	]	P	A	R		C	F		I	D	P	

Starting page

Line 4 of the display/keypad shows the main menus of the menu tree:

- **MEA :** Allows access to the equipment measures, the event list and the fault list.
- **PAR :** Allows access to those programming parameters that can be edited even if the inverter is running, unlike C parameters contained in the CF menus.
- **CF :** Allows access to the configuration parameters that cannot be edited when the inverter is running, unlike P parameters contained in the PAR menu.
- **IDP :** Allows access to the product identification data, the inverter operating time and the language selection page for the display/keypad.

The square brackets indicate the main menu currently selected (e.g. MEA in the figure above). To navigate through the menu use the arrow keys , . To access the selected menu, press the ENTER key.

A navigation scheme of the menu tree is provided in the following page, followed by an example of a parameter programming.

NOTE

Navigation in the Event List menu and the Fault List menu is detailed in the section about the Measures menu.

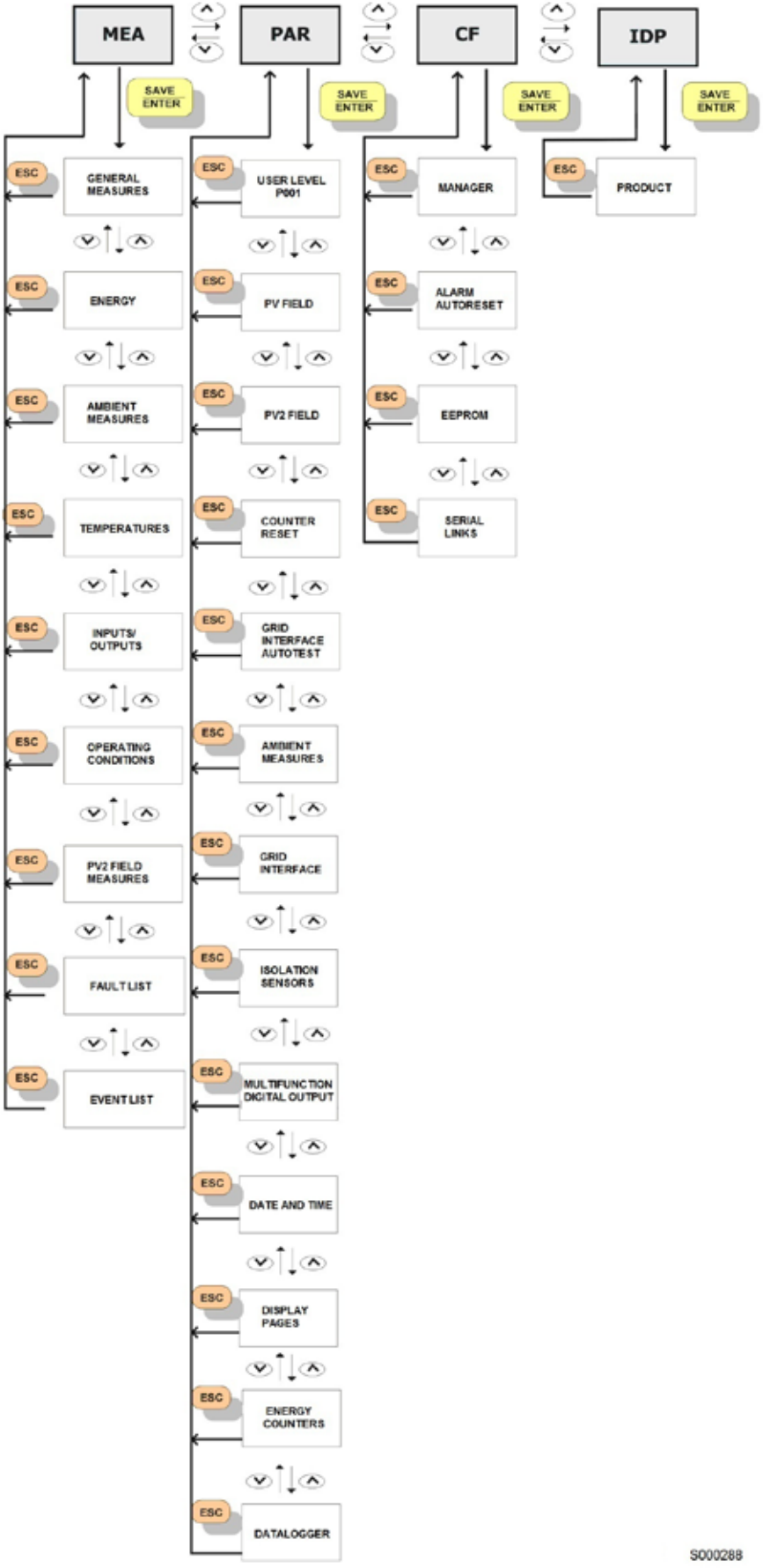


Figure 72: Menu tree

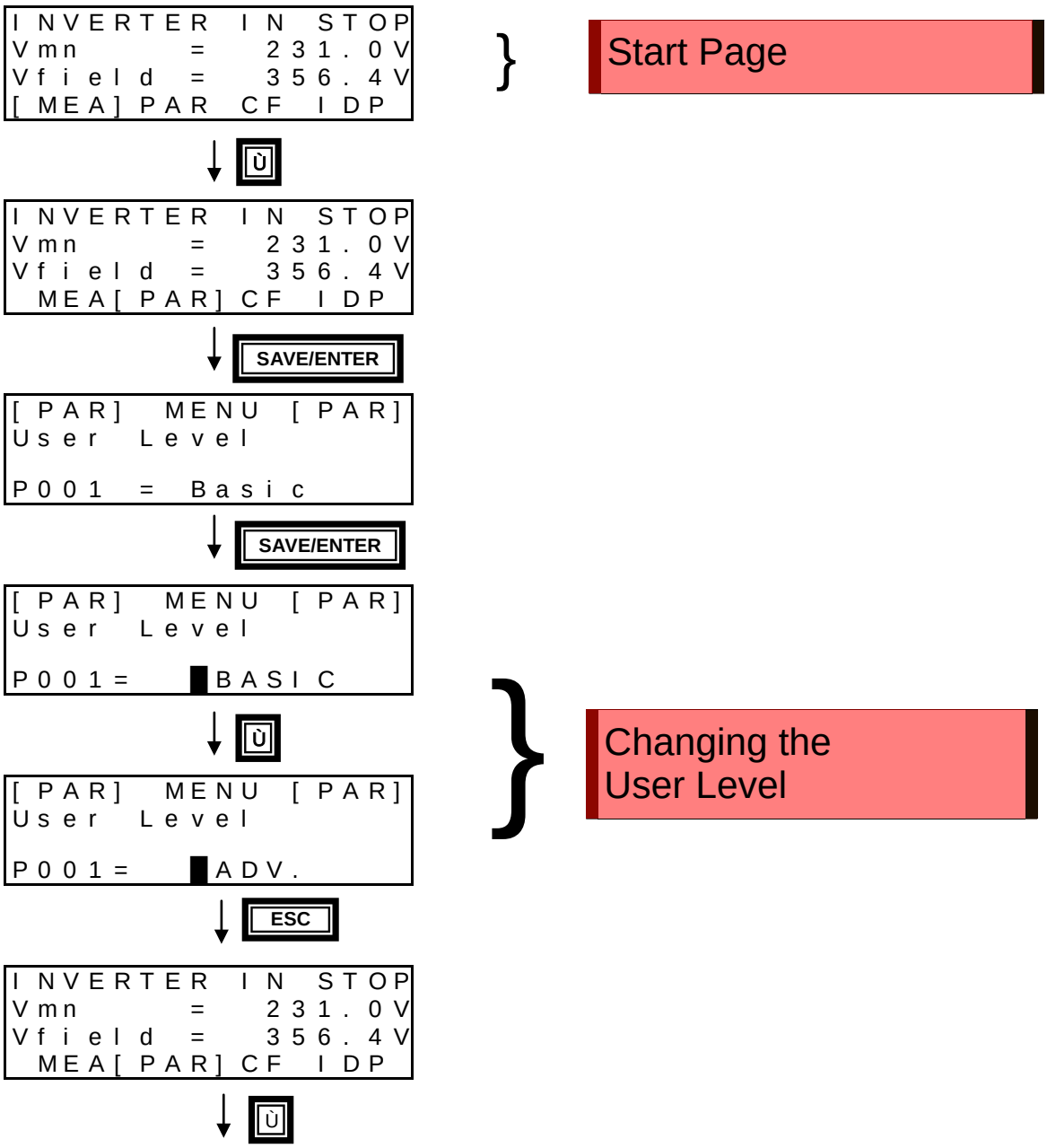
Example of the programming of a parameter:

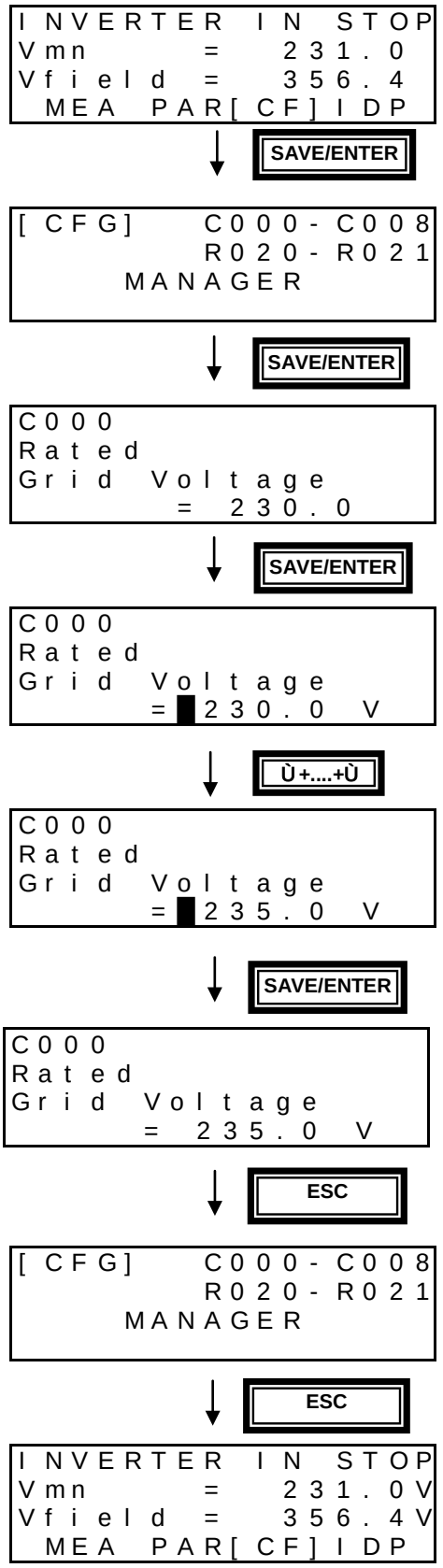
Parameter editing example: rated grid voltage to be changed from 230V to 235V.

Firstly, the user access level is to be changed from 'Basic' to 'Advanced' and then the parameter can be modified as per the procedure shown below.

NOTE

Once the parameter has been changed, by pressing the ESC key to quit the edit mode the new value will be lost upon next power on. By pressing the SAVE/ENTER key to quit the edit mode, the new value will be permanently stored in the inverter.





Changing Parameter C000: Rated Grid Voltage

Return to the Start Page

In the example above, all the new parameter values are stored permanently to the non-volatile memory, so that they will be kept when the inverter is next turned on.

5.1.4. List of the MEASURES and PARAMETERS

5.1.4.1. 'M' Measures

Menu	Measure	Function	Access Level	Modbus Address
GENERAL MEASURES MENU [MEA]	**M000**	Field Voltage	BASIC	1650
	M001	Field Voltage Reference	ADVANCED	1651
	M002	Field Current	BASIC	1652
	M004	Grid Voltage	BASIC	1654
	M005	Grid Frequency	BASIC	1655
	M006	Grid Current	BASIC	1656
	M008	Active Power Delivered to the Grid	BASIC	1658
	M010	Total Active Energy Delivered to the Grid [KWh]	BASIC	1661-1662
	M011	Partial Active Energy Delivered to the Grid [KWh]	BASIC	1663-1664
	M015	Grid Events Counter KO	ADVANCED	1669
	M016	PV Field KO Event Counter	ADVANCED	1670
	M017	Isolation Voltage	ADVANCED	1671
	M018	Positive pole isolation resistance (+)	ADVANCED	1672
	M019	Negative pole isolation resistance (-)	ADVANCED	1673
ENERGY MENU [MEA]	**M200**	Total Value of the Energy Count	BASIC	1807
	M201	Partial Value of the Energy Count	BASIC	1809
	M010	Total Active Energy Delivered to the Grid [KWh]	BASIC	1661-1662
	M011	Partial Active Energy Delivered to the Grid [KWh]	BASIC	1663-1664
AMBIENT MEASURES MENU [MEA]	**M032**	Solar Radiation Intermediate Measure	ADVANCED	1682
	M033	Modules Temperature Intermediate Measure	ADVANCED	1683
	M034	Ambient Temperature Intermediate Measure	ADVANCED	1684

Menu	Measure	Function	Access Level	Modbus Address
	M035	Solar Radiation	BASIC	1685
	M036	Modules Temperature	BASIC	1686
	M037	Ambient Temperature	BASIC	1687
	M110*	Ambient Measure 4	BASIC	1688
	M111*	Ambient Measure 5	BASIC	1689
	M112*	Ambient Measure 6	BASIC	1690
	M113*	Ambient Measure 7	BASIC	1691
	M114*	Ambient Measure 8	BASIC	1692
	M115*	Ambient Measure 9	BASIC	1693
	M116*	Intermediate Ambient Measure 4	ADVANCED	1710
	M117*	Intermediate Ambient Measure 5	ADVANCED	1711
	M118*	Intermediate Ambient Measure 6	ADVANCED	1712
	M119*	Intermediate Ambient Measure 7	ADVANCED	1713
	M120*	Intermediate Ambient Measure 8	ADVANCED	1714
	M121*	Intermediate Ambient Measure 9	ADVANCED	1715
TEMPERATURES MENU [MEA]	**M057**	CPU Temperature (Control Board)	ADVANCED	1707
	M059	IGBT Heat Sink Temperature	ADVANCED	1709
INPUTS/OUTPUTS MENU [MEA]	**M030**	Digital Inputs	ADVANCED	1680
	M031	Digital Outputs	ADVANCED	1681
OPERATING STATUS MENU [MEA]	**M052**	HW Status	ADVANCED	1702
	M053	PLL status for the connection to the GRID	ADVANCED	1703
	M054	Grid 1 Status	ADVANCED	1704
	M055	Grid 2 Status	ADVANCED	1705
	M089	Inverter Status	BASIC	1739
	M090	Active Alarm	BASIC	1740
	M097	Power Delivery Time	ADVANCED	1659-1660
	M098	Operation Time	ADVANCED	1698-1699
	M099	Supply Time	ADVANCED	1716-1717

Menu	Measure	Function	Access Level	Modbus Address
PV2 FIELD MEASURES MENU [MEA]	**M100***	PV2 Field Voltage	BASIC	1674
	M101*	PV2 Field Reference Voltage	ADVANCED	1675
	M102*	PV2 Field Current	BASIC	1676
	M103*	PV2 Field Active Power	BASIC	1677

Table 37: List of 'M' measures

* These measures are available only of the relevant option is installed.

5.1.4.2. 'P' Parameters

Menu	Measure	Function	Access Level	Modbus Address
USER LEVEL ENABLING MENU [PAR]	**P001**	User Level	BASIC	1457
FIELD MENU [PAR]	**P020**	Field Voltage Reference, Manual MPPT	ADVANCED	620
	P021	Min. Time for Radiation OK	ADVANCED	621
	P022	Min. Power for Radiation KO	ADVANCED	622
	P023	Min. Instantaneous Power for Radiation KO	ADVANCED	623
	P024	Min. Power Radiation KO Time	ADVANCED	624
	P025	Min.Instant.Power Radiation KO Time	ADVANCED	625
	P026	MPPT Enable	ADVANCED	626
	P027	MPPT Computing Cycle Time	ADVANCED	627
	P028	MPPT Field Voltage Reference Variation	ADVANCED	628
	P029	PV Modules Vmpp/Voc Ratio	ADVANCED	629
	P030	Fast MPPT Enhancement Factor	ADVANCED	630
PV2 FIELD MENU [PAR]	**P300**	PV2 Field Voltage Reference, Manual MPPT	ADVANCED con PV2	900
	P301	Min. Radiation Time OK	ADVANCED con PV2	901
	P302	MPPT Enable	ADVANCED con PV2	*902*
	P303	PV2 Computing Cycle Time	ADVANCED con PV2	903
	P304	PV2 Field Voltage Reference Variation	ADVANCED con PV2	904
	P306	Min. Field Voltage Reference MPPT2	ADVANCED con PV2	906
	P307	Max. Field Voltage Reference MPPT2	ADVANCED con PV2	907

Menu	Measure	Function	Access Level	Modbus Address
AMBIENT MEASURES MENU [PAR]	**P050**	Ambient Measure 1 Mode	ADVANCED	650
	P051	Ambient Measure 1 Offset	ADVANCED	651
	P052	Ambient Measure 1 Input Filter Time Constant	ADVANCED	652
	P053	Ambient Measure 1 Min. Value	ADVANCED	653
	P054	Ambient Measure 1 Full-scale Value	ADVANCED	654
	P055	Ambient Measure 2 Mode	ADVANCED	655
	P056	Ambient Measure 2 Offset	ADVANCED	656
	P057	Ambient Measure 2 Input Filter Time Constant	ADVANCED	657
	P058	Ambient Measure 2 Min. Value	ADVANCED	658
	P059	Ambient Measure 2 Full-scale Value	ADVANCED	659
	P060	Ambient Measure 3 Mode	ADVANCED	660
	P061	Ambient Measure 3 Offset	ADVANCED	661
	P062	Ambient Measure 3 Input Filter Time Constant	ADVANCED	662
	P063	Ambient Measure 3 Min. Value	ADVANCED	663
	P064	Ambient Measure 3 Full-scale Value	ADVANCED	664
	P320*	Type of Signal on AIN4 Input	ADVANCED	920
	P321*	Offset Correction Value on AIN4 Input	ADVANCED	921
	P322*	Measure Selected on AIN4	ADVANCED	922
	P323*	Min. Value of the Measure Selected on AIN4	ADVANCED	923
	P324*	Full-scale Value of the Measure Selected on AIN4	ADVANCED	924
	P326*	Type of Signal on AIN5 Input	ADVANCED	926
	P327*	Offset Correction Value on AIN5 Input	ADVANCED	927
	P328*	Measure Selected on AIN5	ADVANCED	928
	P329*	Min. Value of the Measure Selected on AIN5	ADVANCED	929
	P330*	Full-scale Value of the Measure Selected on AIN5	ADVANCED	930

Menu	Measure	Function	Access Level	Modbus Address
	P332*	Type of Signal on AIN6 Input	ADVANCED	932
	P333*	Offset Correction Value on AIN6 Input	ADVANCED	933
	P334*	Measure Selected on AIN6	ADVANCED	934
	P335*	Min. Value of the Measure Selected on AIN6	ADVANCED	935
	P336*	Full-scale Value of the Measure Selected on AIN6	ADVANCED	936
	P338*	Type of Signal on AIN7 Input	ADVANCED	938
	P339*	Offset Correction Value on AIN7 Input	ADVANCED	939
	P340*	Measure Selected on AIN7	ADVANCED	940
	P341*	Min. Value of the Measure Selected on AIN7	ADVANCED	941
	P342*	Full-scale Value of the Measure Selected on AIN7	ADVANCED	942
	P344*	Type of Signal on AIN8 Input	ADVANCED	944
	P345*	Offset Correction Value on AIN8 Input	ADVANCED	945
	P346*	Measure Selected on AIN8	ADVANCED	946
	P347*	Min. Value of the Measure Selected on AIN8	ADVANCED	947
	P348*	Full-scale Value of the Measure Selected on AIN8	ADVANCED	948
	P350*	Type of Signal on AIN9 Input	ADVANCED	950
	P351*	Offset Correction Value on AIN9 Input	ADVANCED	951
	P352*	Measure Selected on AIN9	ADVANCED	952
	P353*	Min. Value of the Measure Selected on AIN9	ADVANCED	953
	P354*	Full-scale Value of the Measure Selected on AIN9	ADVANCED	954
GRID INTERFACE MENU [PAR]	**P080**	Instantaneous Overvoltage Threshold	See “Certification and Grid Interface File”	680
	P081	Inst. Overvoltage Release Ratio	See “Certification and Grid Interface File”	681
	P082	Inst. Overvoltage Trip Time	See “Certification and Grid Interface	682

Menu	Measure	Function	Access Level	Modbus Address
			File”	
	P083	Inst. Overvoltage Reset Time	See “Certification and Grid Interface File”	683
	P084	MAX Voltage Trip Threshold	See “Certification and Grid Interface File”	684
	P085	MAX Voltage Release Ratio	See “Certification and Grid Interface File”	685
	P086	MAX Voltage Trip Time	See “Certification and Grid Interface File”	686
	P087	MAX Voltage Reset Time	See “Certification and Grid Interface File”	687
	P088	Min. Voltage Trip Threshold	See “Certification and Grid Interface File”	688
	P089	Min. Voltage Release Ratio	See “Certification and Grid Interface File”	689
	P090	Min. Voltage Trip Time	See “Certification and Grid Interface File”	690
	P091	Min. Voltage Reset Time	See “Certification and Grid Interface File”	691
	P092	Instantaneous Undervoltage Threshold	See “Certification and Grid Interface File”	692
	P093	Inst. Undervoltage Release Ratio	See “Certification and Grid Interface File”	693
	P094	Inst. Undervoltage Trip Time	See “Certification and Grid Interface File”	694
	P095	Inst. Undervoltage Reset Time	See “Certification and Grid Interface File”	695
	P096	MAX Frequency Trip Threshold	See “Certification and Grid Interface File”	696
	P097	MAX Frequency Release Ratio	See “Certification and Grid Interface File”	697
	P098	MAX Frequency Trip Time	See “Certification and Grid Interface File”	698
	P099	MAX Frequency Reset Time	See “Certification	699

Menu	Measure	Function	Access Level	Modbus Address
			and Grid Interface File"	
	P100	Min. Frequency Trip Threshold	See "Certification and Grid Interface File"	700
	P101	Min. Frequency Release Ratio	See "Certification and Grid Interface File"	701
	P102	Min. Frequency Trip Time	See "Certification and Grid Interface File"	702
	P103	Min. Frequency Reset Time	See "Certification and Grid Interface File"	703
	P104	MAX Frequency Derivative Trip Threshold	See "Certification and Grid Interface File"	704
	P105	MAX Frequency Derivative Release Ratio	See "Certification and Grid Interface File"	705
	P106	MAX Frequency Derivative Trip Time	See "Certification and Grid Interface File"	706
	P107	MAX Frequency Derivative Reset Time	See "Certification and Grid Interface File"	707
	P122	Average Overvoltage Threshold	See "Certification and Grid Interface File"	722
ISOLATION SENSORS MENU [PAR]	**P120**	Min. Isolation Resistance	ADVANCED	720
	P121	Isolation Sensor Trip Delay	ADVANCED	721
MULTIFUNCTION DIGITAL OUTPUT MENU [PAR]	**P235**	MDO4 Output Logic Level	ADVANCED	835
	P236	Activation Delay	ADVANCED	836
	P237	Deactivation Delay	ADVANCED	837
	P238	MDO4 Output Signal Selection	ADVANCED	838
DATE & TIME MENU [PAR]	**P391***	Day of the Week to be changed	BASIC	991
	P392*	Day of the Month to be changed	BASIC	992
	P393*	Month to the changed	BASIC	993

Menu	Measure	Function	Access Level	Modbus Address
	P394*	Year to be changed	BASIC	994
	P395*	Time (Hour) to be changed	BASIC	995
	P396*	Time (Minutes) to be changed	BASIC	996
	P398*	Clock/Calendar Editing Command	BASIC	998
KEYPAD PAGES MENU [PAR]	**P266**	Starting page	ADVANCED	866
	P268	Measure n.1 on Status Page	ADVANCED	Not accessible
	P268a	Measure n.2 on Status Page	ADVANCED	Not accessible
	P268b	Measure n.2 on Monitor Page	ADVANCED	Not accessible
	P268c	Measure n.3 on Monitor Page	ADVANCED	Not accessible
	P268d	Measure n.4 on Monitor Page	ADVANCED	Not accessible
ENERGY COUNTERS MENU [PAR]	**P130**	Energy Count Value per KWh	ADVANCED	676
	P131	External Energy Counter Function	ADVANCED	731
	P132	Energy Counter Gain	ADVANCED	732
	P134	Pulses per KWh	ADVANCED	734
	P135L	Preset x0.01 Energy Counter	ADVANCED	715
	P135H	Preset x100 Energy Counter	ADVANCED	716
EQUIPMENT MENU [IDP]	**P263**	Language	BASIC	863

Table 38: List of 'P' parameters

* This parameter is available only when the relevant option is installed

5.1.4.3. 'I' Inputs

Menu	Input	Function	Access Level	Modbus Address
COUNTERS RESET MENU [PAR]	**I002**	Partial Energy Counter Reset	ADVANCED	1389
	I003	Grid KO Events Counter Reset	BASIC	1390
	I004	Radiation KO Events Counter Reset	ADVANCED	1391

Menu	Input	Function	Access Level	Modbus Address
	I005	Active Energy Counter Reset	ADVANCED	1392
	I007	Radiation KO Events Counter Reset	ADVANCED	1394
GRID INTERFACE SELF-TEST [PAR]	**I030**	Test for Min. Grid Voltage Trip Threshold	ADVANCED	1417
	I031	Test for Max Grid Voltage Trip Threshold	ADVANCED	1418
	I032	Test for Min. Grid Frequency Trip Threshold	ADVANCED	1419
	I033	Test for Max Grid Frequency Trip Threshold	ADVANCED	1420
EEPROM MENU [CF]	**I012**	EEPROM Management	ADVANCED	1399

Table 39: List of 'I' inputs

5.1.4.4. 'C' Parameters

Menu	Input	Function	Access Level	Modbus Address
MANAGER MENU [CF]	**C000**	Rated Grid Voltage	ADVANCED	1000
	C001	Rated Frequency Voltage	ADVANCED	1001
	C002	Number of Start Attempts	ADVANCED	1002
	C003	Waiting Time in S-BY (C002 Failed Starts)	ADVANCED	1003
	C004	Waiting Time for Stand-by (Grid Interface Protection Relay Tripping)	ADVANCED	1004
	C005	Time for Start OK	ADVANCED	1005
	C006	Interface Protection Configuration	ADVANCED	1006
	C007	PV2 Option	ADVANCED	1007
	C008	Remote Control	ADVANCED	1008
ALARM AUTORESET MENU [CF]	**C033**	Autoreset Pulse Number	ADVANCED	1033
	C034	Reset Time for Autoreset Attempts Counter	ADVANCED	1034

Menu	Input	Function	Access Level	Modbus Address
	C035	Autoreset at Power On	ADVANCED	1035
	C036	Thermal Protection Autoreset Enable	ADVANCED	1036
	C037	Heatsink Overheating Autoreset Enable	ADVANCED	1037
	C038	IGBT Fault Autoreset Enable	ADVANCED	1038
	C039	Overcurrent Autoreset Enable	ADVANCED	1039
	C040	Overvoltage Autoreset Enable	ADVANCED	1040
	C041	Serial Link Fault Autoreset Enable	ADVANCED	1041
	C042	Ambient Overtemperature Autoreset Enable	ADVANCED	1042
	C043	Cooling Time	ADVANCED	1043
	C044	PV Isolation Fault Control	ADVANCED	1044
	C045	Isolation Fault Autoreset Enable	ADVANCED	1045
	C046	On-Alarm Buzzer Enable	ADVANCED	1046

Table 40: List of 'C' parameters

5.1.4.5. 'R' Parameters

Menu	Input	Function	Access Level	Modbus Address
DATA LOGGER MENU [PAR]				
Ethernet & Modem Menu [PAR]	**R100***	IP address high	BASIC	1332
	R101*	IP address low	BASIC	1333
	R102*	IP mask high	BASIC	1334
	R103*	IP mask low	BASIC	1335
	R104+ R105+ R106*	SMS 1 Phone No.	BASIC	569, 570, 571
	R108+ R109+ R110*	SMS 2 Phone No.	ADVANCED	572, 573, 574
	R111*	PPP IN Username	BASIC	575
	R112*	PPP IN Password	BASIC	576
	R113*	PPP OUT Username	BASIC	577
	R114*	PPP OUT Password	BASIC	578
	R115*	SIM card PIN	BASIC	563
MANAGER MENU [CF]	**R020**	Data Logger Option	ADVANCED	219
	R021	Ambient Sensors and Field I/Os Expansion Option	ADVANCED	294
SERIAL LINKS MENU [CF]	**R001**	Inverter Modbus Address for Serial Link 0	ADVANCED	588
	R002	Response Delay for Serial Link 0	ADVANCED	589
	R003	Baud Rate for Serial Link 0	ADVANCED	590
	R004	Time Added to 4byte-time for Serial Link 0	ADVANCED	591
	R005	Watchdog Time for Serial Link 0	ADVANCED	592
	R006	Parity Bit for Serial Link 0	ADVANCED	593

Table 41: List of 'R' parameters

* This parameter is available only when the relevant option is installed.

5.2. MEASURES MENU [MEA]

5.2.1. Description

The Measures Menu includes all the variables measured by the inverter and available for displaying to the user.

In the display/keypad, measures are divided into sub-units grouped by the type of measure.

The sub-units of the measures available are the following:

General Measures Menu

This menu allows displaying the measurements of current, voltage, power and energy delivered from the inverter, the counters for the Grid KO Events and the Solar Radiation KO Events, and the Energy Delivery Time.

Energy Menu

This menu allows displaying the measurements of the Active Energy delivered and the Energy Count.

Ambient Measures Menu

This menu allows displaying the values acquired by the ambient sensors.

Temperatures Menu

This menu allows displaying the temperature measures of the inverter available to the user: the temperature of the control board and the temperature of the IGBT heatsink.

Input/Output Menu

This menu allows displaying the measures of the ambient variables and the digital inputs/outputs of the inverter.

Operating Conditions Menu

This menu allows displaying the inverter status, the alarms tripped (if any) and the hardware status.

PV2 Field Measures Menu (only available if the Additional PV Field option is installed)

This menu allows displaying the measurements of current, voltage and energy for the Additional PV Field PV2.

Fault List Menu

This menu allows displaying the list of the last 8 alarms tripped.

Event List Menu

This menu allows displaying the list of the last 8 events.

5.2.2. GENERAL MEASURES MENU M000 ÷ M019

Menu	Input	Function	Access Level
M000	Field Voltage	BASIC	1650
M001	Field Voltage Reference	ADVANCED	1651
M002	Field Current	BASIC	1652
M004	Grid Voltage	BASIC	1654
M005	Grid Frequency	BASIC	1655
M006	Grid Current	BASIC	1656
M008	Active Power	BASIC	1658
M010	Total Energy Delivered [KWh]	BASIC	1661-1662
M011	Partial Energy Delivered [KWh]	BASIC	1663-1664
M015	Grid KO Events Counter	ADVANCED	1669
M016	PV Field KO Events Counter	ADVANCED	1670
M017	Isolation Voltage	ADVANCED	1671
M018	Positive Pole Isolation Resistance (+)	ADVANCED	1672
M019	Negative Pole Isolation Resistance (-)	ADVANCED	1673

Table 42: List of the measurements on the General Measures Menu M000 ÷ M019

M000 Field Voltage

M000	**Range**	0 ÷ 10000	0 ÷ 1000.0 V
Field Voltage	**Address**	1650	
	User level	BASIC	
	Function	Measured (DC-bus) field voltage.	

M001 Field Voltage Reference

M001	**Range**	0 ÷ 10000	0 ÷ 1000.0 V
Field Voltage Reference	**Address**	1651	
	User level	ADVANCED	
	Function	When the inverter is running, this is the measure of the DC-bus voltage reference generated by the MPPT function. When the inverter is not running, this is the measure of the PV field voltage.	

M002 Field Current

M002	Range	0 ÷ 65000	0 ÷ 65.000 A
Field Current	Address	1652	
	User level	BASIC	
	Function	Measured (DC-bus) field current.	

M004 Grid Voltage

M004	Range	0 ÷ 10000	0 ÷ 1000.0 V
Grid Voltage	Address	1654	
	User level	BASIC	
	Function	Measured Grid Voltage.	

M005 Grid Frequency

M005	Range	± 10000	± 100.00 Hz
Grid Frequency	Address	1655	
	User level	BASIC	
	Function	Measured Grid Frequency.	

M006 Grid Current

M006	Range	0 ÷ 65000	0 ÷ 65.000 A
Grid Current	Address	1656	
	User level	BASIC	
	Function	Grid Current (measured downstream of the output transformer).	

M008 Active Power Delivered to the Grid

M008	Range	± 32000	± 32000 W
Active Power	Address	1658	
	User level	BASIC	
	Function	Active power delivered.	

M010 Active Energy Delivered to the Grid

M010	Range	± 320000000	± 3200000.00 kWh
Active Energy	Address	1661,1662	
	User level	BASIC	
	Function	Total energy delivered since the commissioning of the equipment. This measure is a value expressed in 32bits divided into two 16-bits words: the low part and the high part. This measure can be reset with parameter I005 (COUNTERS RESET MENU I002 ÷ I007).	

M011 Partial Active Energy Delivered to the Grid

M011	Range	± 320000000	± 3200000.00 kWh
Partial Energy Delivered	Address	1663,1664	
	User level	BASIC	
	Function	Partial active energy delivered. This measure is a value expressed in 32bits divided into two 16-bits words: the low part and the high part. This measure can be reset with parameter I002 (COUNTERS RESET MENU I002 ÷ I007).	

M015 Grid KO Events Counter

M015	Range	0 ÷ 65000	0 ÷ 65000
Grid KO Events	Address	1669	
	User level	ADVANCED	
	Function	Number of grid failure events.	

M016 PV Field KO Event Counter

M016	Range	0 ÷ 65000	0 ÷ 65000
PV Field KO Event Counter	Address	1670	
	User level	ADVANCED	
	Function	Number of ‘no solar radiation’ events.	

M017 Isolation Voltage

M017	Range	0 ÷ 65000	0 ÷ 65000 V
Isolation Voltage	Address	1671	
	User level	ADVANCED	
	Function	Isolation voltage of the PV Field.	

M018 Positive Pole Isolation Resistance (+)

M018	Range	0 ÷ 65535	0 ÷ 6553.5 kΩ
Isolation Resistance (+)	Address	1672	
	User level	ADVANCED	
	Function	Value of the isolation resistance between the ground and the positive pole of the PV field. An isolation resistance exceeding the value set as the max allowable isolation resistance (P120) is displayed as “OK”.	

M019 Negative Pole Isolation Resistance (-)

M019	Range	0 ÷ 65535	0 ÷ 6553.5 kΩ
Isolation Resistance (-)	Address	1673	
	User level	ADVANCED	
	Function	Value of the isolation resistance between the ground and the negative pole of the PV field. An isolation resistance exceeding the value set as the max allowable isolation resistance (P120) is displayed as “OK”.	

5.2.3. ENERGY MENU M200 ÷ M201-M010 ÷ M011

This submenu allows displaying the measures relating to the inverter energy values (total active energy and partial active energy) as well as the value of the total energy count and the partial energy count.

Measure	Description	Access Level	Modbus Address
M200	Total Value of the Energy Count	BASIC	1807
M201	Partial Value of the Energy Count	BASIC	1809
M010	Total Energy Delivered [KWh]	BASIC	1661-1662
M011	Partial Energy Delivered [KWh]	BASIC	1663-1664

M200 Total Value of the Energy Count

M200	Range	± 320000000	± 320000.000 euro
Total Value of the Energy Count	Level	BASIC	
	Address	1807	
	Function	This measure represents the overall value of the Energy Count.	

M201 Partial Value of the Energy Count

M201			
Partial Value of the Energy Count	Range	± 320000000	± 320000.000 euro
	Level	BASIC	
	Address	1809	
	Function	This measure represents the partial value of the Energy Count.	

M010 Active Energy Delivered to the Grid

M010			
Active Energy	Range	± 320000000	± 3200000.00 kWh
	Address	1661,1662	
	User level	BASIC	
	Function	Total active energy delivered to the grid since the commissioning of the equipment. This measure is a value expressed in 32bits divided into two 16-bits words: the low part and the high part. This measure can be reset with parameter I005 (COUNTERS RESET MENU I002 ÷ I007).	

M011 Partial Energy Delivered to the Grid

M011			
Partial Energy Delivered	Range	± 320000000	± 3200000.00 kWh
	Address	1663,1664	
	User level	BASIC	
	Function	Partial Active Energy Delivered. This measure is a value expressed in 32bits divided into two 16-bits words: the low part and the high part. This measure can be reset with parameter I002 (COUNTERS RESET MENU I002 ÷ I007).	

5.2.4. AMBIENT MEASURES MENU M032÷M037 - M110 ÷ M121

This submenu allows displaying six variables acquired from the PV field under the form of electric signals. There is a complete series of input types available (0¸100mV, 0¸10V, 0/4¸20mA, PT100). This allows interfacing with most types of sensors. All inputs can be variously configured for what concerns the physical variable to be represented. The first four inputs can be configured electrically (it is possible to set the type of output of the transducer to be connected).

Factory-setting allows using the first three inputs to acquire the main ambient variables (solar radiation, ambient temperature and module temperature) that affect the photovoltaic generator.

The Ambient Sensors and Field I/Os Expansion Board is required to use ambient measures 4 to 9.

Measure	Description	Access Level	Modbus Address
M032	Solar Radiation Intermediate Measure	ADVANCED	1682
M033	Module Temperature Intermediate Measure	ADVANCED	1683
M034	Ambient Temperature Intermediate Measure	ADVANCED	1684
M035	Solar Radiation	BASIC	1685
M036	Module Temperature	BASIC	1686
M037	Ambient Temperature	BASIC	1687
M110	Ambient Measure 4	BASIC	1688
M111	Ambient Measure 5	BASIC	1689
M112	Ambient Measure 6	BASIC	1690
M113	Ambient Measure 7	BASIC	1691
M114	Ambient Measure 8	BASIC	1692
M115	Ambient Measure 9	BASIC	1693
M116	Intermediate Ambient Measure 4	ADVANCED	1710
M117	Intermediate Ambient Measure 5	ADVANCED	1711
M118	Intermediate Ambient Measure 6	ADVANCED	1712
M119	Intermediate Ambient Measure 7	ADVANCED	1713
M120	Intermediate Ambient Measure 8	ADVANCED	1714
M121	Intermediate Ambient Measure 9	ADVANCED	1715

Table 43: List of the measures in the Ambient Measures Menu M032 ÷ M037 - M110 ÷ M121

NOTE

When the Additional PV Field (PV2) is installed, measures M032, M033, M034, M035, M036, M037 are not available.

M032 Solar Radiation Intermediate Measure (Terminal 2)

M032	**Range**	Programming of P050		
		0 ÷ 10 V	0 ÷ 1000	0 ÷ 10.00 V
		0 ÷ 20 mA o 4 ÷ 20 mA	0 ÷ 2000	0.20.00 mA
Solar Radiation Intermediate Measure (Terminal 2)	**Active**	This measure is detected only if ambient input 1 has been activated through parameter P050.		
	Address	1682		
	Level	ADVANCED		
	Function	Measure of the voltage/current value detected by the inverter at the REF analogue input. **NOTE**: This measure is available only if the value of P050 is higher than 0 (PV1 only).		

M033 Modules Temperature Intermediate Measure (Terminals 5-6)

M033	**Range**	Programming of P055		
		0 ÷ 10 V	0 ÷ 1000	0 ÷ 10.00 V
		0 ÷ 20 mA o 4 ÷ 20 mA	0 ÷ 2000	0.20.00 mA
Modules Temperature Intermediate Measure (Terminals 5-6)	**Active**	This measure is detected only if ambient input 2 has been activated through parameter P055.		
	Address	1683		
	Level	ADVANCED		
	Function	Measure of the voltage/current value detected by the inverter at the AIN1 analogue input. **NOTE**: This measure is available only if the value of P055 is higher than 0 (No Input) and at the same time C007 is 0 (PV1 ONLY).		

M034 Ambient Temperature Intermediate Measure (Terminals 7-8)

M034	**Range**	Programming of P060		
		0 ÷ 10 V	0 ÷ 1000	0 ÷ 10.00 V
		0 ÷ 20 mA o 4 ÷ 20 mA	0 ÷ 2000	0.20.00 mA
Ambient Temperature Intermediate Measure (Terminals 7-8)	**Active**	This measure is detected only if ambient input 3 has been activated through parameter P060.		
	Address	1684		
	Level	ADVANCED		
	Function	Measure of the voltage/current value detected by the inverter at the AIN2 analogue input. **NOTE**: This measure is available only if the value of P060 is higher than 0 (No Input) and at the same time C007 is 0 (PV1 ONLY).		

M035 Solar Radiation

M035	**Range**	0 ÷ 65535	0 ÷ 65535 W/m2
Solar Radiation	**Active**	Always	
	Address	1685	
	Level	BASIC	
	Function	Measure of the solar radiation intensity.	

M036 Modules Temperature

M036	**Range**	-32768 ÷ +32767	-3276.8 ÷ +3276.7 °C
Modules Temperature	**Active**	This value is detected only if ambient input 2 has been activated through parameter P055.	
	Address	1686	
	Level	BASIC	
	Function	Value of modules temperature.	

M037 Ambient Temperature

M037	Range	-32768 ÷ +32767	-3276.8 ÷ +3276.7 °C
Ambient Temperature	Active	This value is detected only if ambient input 3 has been activated through parameter P060.	
	Address	1687	
	Level	BASIC	
	Function	Value of ambient temperature.	

M110 Ambient Measure 4

M110	Range	± 32000	± 3200.0
Ambient Measure 4	Address	1688	
	Level	BASIC	
	Function	Measurement value depending on the settings of parameters P320, P321, P322, P323 and P324 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M111 Ambient Measure 5

M111	Range	± 32000	± 3200.0
Ambient Measure 5	Address	1689	
	Level	BASIC	
	Function	Measurement value depending on the settings of parameters P326, P327, P328, P329 and P330 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M112 Ambient Measure 6

M112	Range	± 32000	± 3200.0
Ambient Measure 6	Address	1690	
	Level	BASIC	
	Function	Measurement value depending on the settings of parameters P332, P333, P334, P335 and P336 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M113 Ambient Measure 7

M113	Range	± 32000	± 3200.0
Ambient Measure 7	Address	1691	
	Level	BASIC	
	Function	Measurement value depending on the settings of parameters P338, P339, P340, P341 and P342 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M114 Ambient Measure 8

M114	Range	± 32000	± 3200.0
Ambient Measure 8	Address	1692	
	Level	BASIC	
	Function	Measurement value depending on the settings of parameters P344, P345, P346, P347 and P348 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M115 Ambient Measure 9

M115	Range	± 32000	± 3200.0
Ambient Measure 9	Address	1693	
	Level	BASIC	
	Function	Measurement value depending on the settings of parameters P350, P351, P352, P353 and P354 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M116 Intermediate Measure for Analogue Channel 4

M116	Range	± 32000	± 3200.0
Intermediate Measure for Analogue Channel 4	Address	1710	
	Level	ADVANCED	
	Function	Value of the direct (electric) measure on the analogue channel 4, depending on the settings of parameters P320, P321, P322, P323 and P324 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M117 Intermediate Measure for Analogue Channel 5

M117	Range	± 32000	± 3200.0
Intermediate Measure for Analogue Channel 5	Address	1711	
	Level	ADVANCED	
	Function	Value of the direct (electric) measure on the analogue channel 5, depending on the settings of parameters P326, P327, P328, P329 and P330 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M118 Intermediate Measure for Analogue Channel 6

M118	Range	± 32000	± 3200.0
Intermediate Measure for Analogue Channel 6	Address	1712	
	Level	ADVANCED	
	Function	Value of the direct (electric) measure on the analogue channel 6, depending on the settings of parameters P332, P333, P334, P335 and P336 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M119 Intermediate Measure for Analogue Channel 7

M119	Range	± 32000	± 3200.0
Intermediate Measure for Analogue Channel 7	Address	1713	
	Level	ADVANCED	
	Function	Value of the direct (electric) measure on the analogue channel 7, depending on the settings of parameters P338, P339, P340, P341 and P342 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M120 Intermediate Measure for Analogue Channel 8

M120	Range	± 32000	± 3200.0
Intermediate Measure for Analogue Channel 8	Address	1714	
	Level	ADVANCED	
	Function	Value of the direct (electric) measure on the analogue channel 8, depending on the settings of parameters P344, P345, P346, P347 and P348 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

M121 Intermediate Measure for Analogue Channel 9

M121	Range	± 32000	± 3200.0
Intermediate Measure for Analogue Channel 9	Address	1715	
	Level	ADVANCED	
	Function	Value of the direct (electric) measure on the analogue channel 9, depending on the settings of parameters P350, P351, P352, P353 and P354 (see the AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354) for the full programming of the parameters). The Ambient Sensors and Field I/Os Expansion Board must be present (fitted as an option).	

5.2.5. TEMPERATURES MENU M057 ÷ M059

This submenu allows displaying the temperature values detected internally to the inverter module.

Measure	Description	Access Level	Modbus Address
M057	CPU Temperature (Control Board)	ADVANCED	1707
M059	IGBT Temperature	ADVANCED	1709

Table 44: List of the measures in the Temperatures Menu M057 ÷ M059

M057 CPU Temperature Measure (Control Board)

M057	Range	± 32000	± 320.0 °C
CPU Temperature Measure (Control Board)	Address	1707	
	Level	ADVANCED	
	Function	Measure of the control board temperature.	

M059 IGBT Temperature Measure

M059	Range	± 11500	± 115.0 °C
IGBT Temperature Measure	Address	1709	
	Level	ADVANCED	
	Function	Measure of the IGBT temperature.	

5.2.6. INPUTS/OUTPUTS MENU M030 ÷ M031

This submenu allows displaying the status of the digital inputs and outputs.

Measure	Description	Access Level	Modbus Address
M030	Digital Inputs	ADVANCED	1680
M031	Digital Outputs	ADVANCED	1681

Table 45: List of the measures in the Inputs/Outputs Menu M030 ÷ M031

M030 Digital Inputs

M030	**Range**	Bit-controlled measure. See encoding	See display representation
Digital Inputs	**Address**	1680	
	Level	ADVANCED	
	Function	Status of the digital inputs	

Bit no.	Digital Input
0	MDI1
1	MDI2(ENABLE)
2	MDI3(RESET)
3	MDI4
4	MDI5
5	MDI6
6	MDI7
7	MDI8

```
M 0 3 0
D i g i t a l   I n p u t s
                1 2 3 4 5 6 7 8
D G I           o o o o o o o o
```

Encoding of measure M030

Representation of the digital input status on the display.

Blank square (bit=0): inactive input

Full square (bit=1): active input.

M031 Digital Outputs

M031	**Range**	Bit-controlled measure. See encoding	See display representation
Digital Outputs	**Address**	1681	
	Level	ADVANCED	
	Function	Status of the digital outputs MDO1 ÷ 4.	

Bit no.	Digital Output
0	MDO1
1	MDO2
2	MDO3
3	MDO4

```
M 0 3 1
D i g i t a l   O u t p u t s
M D O           1   2   3   4
                =  o   o   o   o
```

Encoding of measure M031 Representation of the digital output status on the display.
Blank square (bit=0): inactive output
Full square (bit=1): active output.

5.2.7. OPERATING STATUS MENU M052 ÷ M055 - M089 ÷ M099

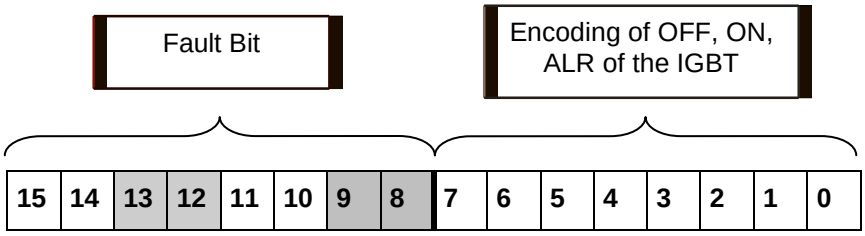
This submenu allows displaying all the information relevant to the operating status of the inverter.

Measure	Description	Access Level	Modbus Address
M052	HW Status	ADVANCED	1702
M053	PLL Status	ADVANCED	1703
M054	Grid Status 1	ADVANCED	1704
M055	Grid Status 2	ADVANCED	1705
M089	Inverter Status	BASIC	1739
M090	Active Alarm	BASIC	1740
M097	Power Delivery Time	ADVANCED	1659-1660
M098	Supply Time	ADVANCED	1698-1699
M099	Operation Time	ADVANCED	1716-1717

Table 46: List of the measures in the Operating Status menu M052 ÷ M055, M089 ÷ M099

M052 Hardware Status

M052	Range	See encoding	See encoding
Hardware Status	Address	1702	
	Level	ADVANCED	
	Function	Hardware status of the inverter.	



IGBT status encoding

00000000=OFF

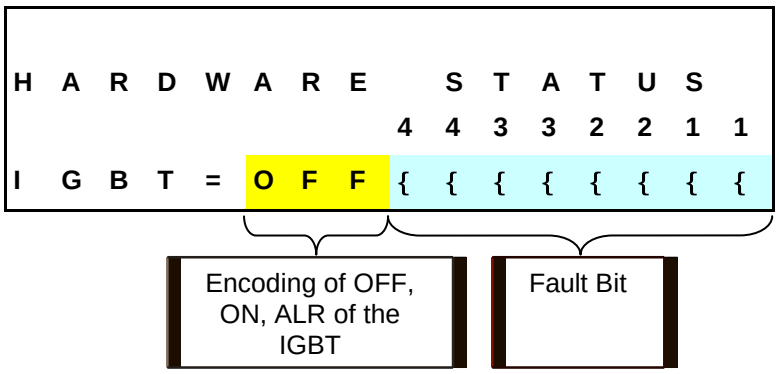
00000001=ON

00000010=ALR

Fault No.	Type of Fault	Meaning of Each Bit (1=TRUE 0=FALSE)
1	IGBT Power Converter Fault	Bit 8: Successful edge of the fault signal
		Bit 9: Current status of the fault signal
2	Signal of Hardware Overcurrent (OC)	Bit 10: Successful edge of the fault signal
		Bit 11: Current status of the fault signal
3	Not Used	
4	PWMENA; return of the IGBT drive command.	Bit 14: Successful return of the command.
		Bit 15: Current status of the return of the IGBT command.

Table 47: Encoding of the inverter bit fault

The display representation is as follows:



M053 PLL Status for the Connection to the Grid

M053	Range	0.1, 3	See Table 48
PLL Status for the Connection to the Grid	Address	1703	
	Level	ADVANCED	
	Function	It displays the status of the PLL that performs the synchronization with the grid.	

No.	Value	Description
0	MEA_IDLE	PLL stopped
1	MEA_INITPOS	Synchronising…
3	MEA_LOCKPOS	Synchronised

Table 48: Encoding of measure M053

M054 Grid Status 1

M054	Range	0 ÷ 1023 0x0000 h ÷ 0x03 ffh bit-controlled	See Table 49
Grid Status 1	Address	1704	
	Level	ADVANCED	
	Function	It displays the status of certain grid faults.	

Bit no.	Description
0	Max Instantaneous Voltage
1	Not used
2	Not used
3	Min Instantaneous Voltage
4	Not used
5	Not used
6	Not used
7	Not used
8	Not used
9	Max Frequency Derivative
A	PLL fault

Table 49: Function of the bits of measure M054 'Grid Status 1'

M055 Grid Status 2

M055	**Range**	0 ÷ 1023 0x0000 h ÷ 0x03 ffh bit-controlled	See Table 50
Grid Status 2	**Address**	1705	
	Level	ADVANCED	
	Function	It displays the status of the remaining grid faults.	

Bit no.	Description
0	Overvoltage
1	Not used
2	Not used
3	Undervoltage
4	Not used
5	Not used
6	Maximum Frequency
7	Minimum Frequency
8	PLL Fault
9	Grid Interface Protection Relay

Table 50: Function of the bits of measure M055 'Grid Status 2'

M089 Inverter Status

M089	**Range**	See Table 51	See Table 51
Inverter Status	**Address**	1739	
	Level	BASIC	
	Function	It describes the operating status of the inverter.	

Status displayed	Modbus Code	Condition
Stand by VFKO	0	The PV field voltage is lower than the starting voltage.
STOP wait EN	1	No ENABLE (factory setting: Enable always present)
Inverter in STOP	2	Status of the inverter when first started and whenever the STOP key in the Display/Keypad is pressed while the inverter is running. Press START to start the inverter.
SYNCHRO	4	Synchronisation with the grid and supply of the internal isolation transformer in progress.
RUN P=*,*kW	6	The inverter is feeding into the grid a power equal to *,*.
ALARM Axx	16	An alarm tripped; Axx is the alarm number.
RESETTING xxxs	18	The Autoreset function has just reset an alarm condition and the inverter is waiting for the reset time to elapse (5s).
S-BY VFKO xxxs	20	The field voltage has reached the starting value; the inverter is waiting for the time set in P021 to elapse before starting (factory setting is 5s).
S-BY GridKO Vmin	21	Grid KO: voltage lower than 80% of the rated value.
SBY GridKO Vmax	22	Grid KO: voltage higher than 120% of the rated value.
SBY GridKO Freq	23	Grid KO: grid frequency out of allowed range (50Hz ± 0.3Hz).
SBY PLL KO	24	Synchronisation with the grid voltage is lost.
S-BY Vgrid xxx.xs	25	Waiting time (5s) after checking that the grid values do not exceed the allowed range.
S-BY OL xxx.xs	26	Cooling phase (300s) following the thermoswitch trip.
S-BY St.KOxxx.xs	27	Waiting time of the timer set in C003 (factory setting: 1800s) after a number of failed starting attempts equal to the value set in C002 (factory setting: 10).
S-BY Relays xxx.xs	28	Waiting time of the timer set in C004 (factory setting: 300s) after restoring the enable signal of the external grid interface protection relay.
SBYGridKORelays	29	Grid KO (in case of operation with the external grid interface protection relay).
SBY high VField	31	Field voltage too high.

Table 51: Encoding of the inverter status

M090 Active Alarm

M090	Range	See 2.9.3 List of the Alarms A001 ÷ A135	See 2.9.3 List of the Alarms A001 ÷ A135
Active Alarm	Address	1740	
	Level	BASIC	
	Function	Currently active alarm.	

M097 Power Delivery Time

M097	Range	$0 \div 2^{32}$	$0 \div 2^{32}$ in units of 200ms displayed as hh:min:sec
Delivery Time	Address	1659, 1660 (LSword, MSword)	
	Level	ADVANCED	
	Function	Working time (hours) of the inverter in power delivery mode. This measure is expressed in 32bits divided into two words (16bits): the low part and the high part. This counter can be reset by the user through parameter I007.	

M098 Operation Time

M098	Range	$0 \div 2^{32}$	$0 \div 2^{32}$ in units of 200ms displayed as hh:min:sec
Operation Time	Address	1698, 1699 (LSword, MSword)	
	Level	ADVANCED	
	Function	This is the inverter operating time (the operating time corresponds to the activation time of the inverter IGBTs). This measure is expressed in 32bits divided into two 16-bit words: the low part and the high part.	

M099 Supply Time

M099	Range	$0 \div 2^{32}$	$0 \div 2^{32}$ in units of 200ms displayed as hh:min:sec
Supply Time	Address	1716, 1717 (LSword, MSword)	
	Level	ADVANCED	
	Function	Working time of the inverter in power on mode. This measure is expressed in 32bits divided into two 16-bit words: the low part and the high part.	

5.2.8. PV2 FIELD MEASURES MENU M100 ÷ M103

This submenu allows displaying the measures for the Additional PV Field (PV2).

This submenu can be viewed only if the PV2 field option is available in the inverter (C007 = 1: PV2 Only, or 2: PV1 + PV2).

Measure	Description	Access Level	Modbus Address
M100	PV2 Field Voltage	BASIC	1674
M101	PV2 Field Voltage Reference	ADVANCED	1675
M102	PV2 Field Current	BASIC	1676
M103	PV2 Field Active Power	BASIC	1677

Table 52: List of the measures in the PV2 Field menu M100 ÷ M103

M100 PV2 Field Voltage

M100	**Range**	0 ÷ 10000	0 ÷ 1000.0 V
PV2 Field Voltage	**Active**	This measure is displayed only if the PV2 Field option is available in the inverter and C007 = 1: PV2 Only, or 2: PV1 + PV2.	
	Address	1674	
	Level	BASIC	
	Function	Voltage value measured for the Additional PV Field (PV2).	

M101 PV2 Field Voltage Reference

M101	**Range**	0 ÷ 10000	0 ÷ 1000.0 V
PV2 Field Voltage Reference	**Active**	This measure is displayed only if the PV2 Field option is available in the inverter and C007 = 1: PV2 Only, or 2: PV1 + PV2.	
	Address	1675	
	Level	ADVANCED	
	Function	When the inverter is running, M101 is the measure of the voltage reference of the additional PV field generated by the MPPT function; when the inverter is not running, this is the measure of the PV2 field voltage.	

M102 PV2 Field Current

M102	Range	0 ÷ 1500	0 ÷ 15.00 A
PV2 Field Current	Active	This measure is displayed only if the PV2 Field option is available in the inverter and C007 = 1: PV2 Only, or 2: PV1 + PV2.	
	Address	1676	
	Level	BASIC	
	Function	Current value measured for the additional PV field (PV2).	

M103 PV2 Field Active Power

M103	Range	± 32000	± 32000 W
PV2 Field Active Power	Address	1677	
	User level	BASIC	
	Function	Power delivered by the additional PV field (PV2).	

5.2.9. FAULT LIST MENU

The Fault List submenu allows displaying the last eight alarms stored by the inverter, and the measurements of a series of characteristic variables recorded when the alarms tripped.

By scrolling through the menu using the arrow keys, the last eight alarms are displayed.

By pressing the **ENTER** key, it is possible to access the submenu of the relevant alarm, which displays the measures recorded by the inverter when the alarm tripped.

The following page shows a navigation example within the **Fault List Menu** (the example is related to alarm no.1). Note that the alarm no. 1 is the latest alarm tripped, while A8 is the first alarm tripped.

The measures marked by Mxxx are the same measures covered in the previous sections.

Measures included in the Fault List menu:

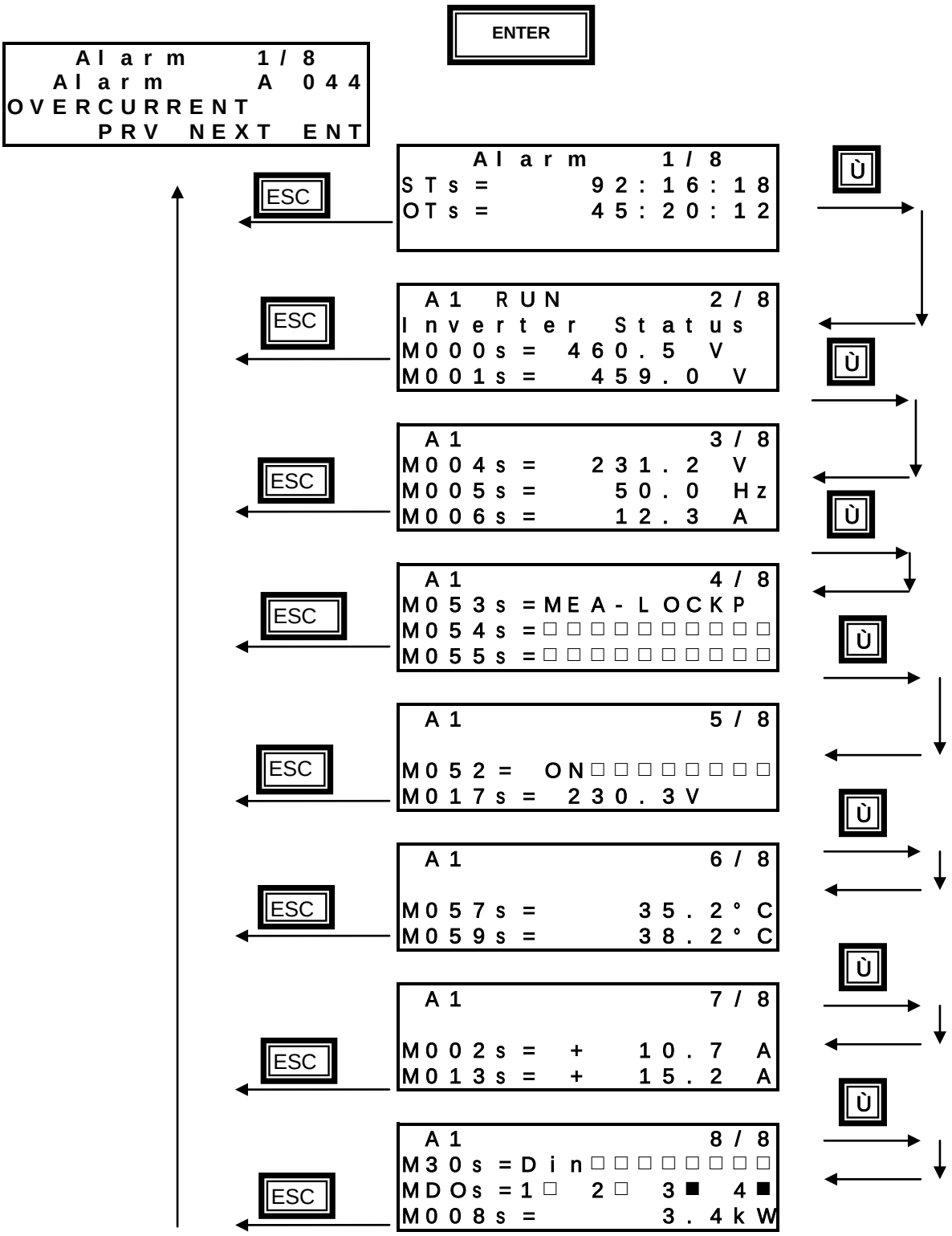
Page of the Fault List	Measure	Description
1	STs	Supply time (hours)
	OTs	Operation time (hours)
2	Status	Inverter status when the alarm tripped
	M000s	Photovoltaic field voltage
	M001s	Field reference
3	M004s	Grid voltage
	M005s	Grid frequency
	M006s	Grid current

Page of the Fault List	Measure	Description
4	M053s	PLL grid status
	M054s	Grid 1 status
	M055s	Grid 2 status
5	M052s	Hardware status
	M017s	Isolation voltage
6	M057s	Ambient temperature measure
	M059s	IGBT temperature measure
7	Ipvs	PV field current
	Iinvs	Inverter current
	Idcs	PV2 inverter current
8	M030s	Digital input status
	M031s	Digital output status
	M008s	Active power delivered to the grid

NOTE

The 's' suffix means that the value is not the current value, but the value detected when the alarm tripped.

Navigation example (Fault List menu).



5.2.10. EVENT LIST MENU

This submenu allows displaying the measures of some characteristic variables detected when specific events fire during the operation of the SUNWAY M PLUS.

By pressing the **ENTER** key it is possible to access the submenu and to scroll through the measures detected by the inverter when an event fired. The measures and codes are the same as the ones included in the FAULT LIST MENU. The navigation mode is the same as the one described in the previous section.

Message	Description
E095 Controlled Stop	The STOP key on the display/keypad has been pressed.
E096 Start	Successful start; the SUNWAY M PLUS operates in parallel with the grid.
E097 RELAYS KO	External protection tripped (if any).
E098 Grid Frequency KO	The grid frequency is out of range (factory-set allowed range: +/-0.3Hz).
E099 Min. Grid V	The grid voltage has dropped below the min allowed value (184V).
E100 Max. Grid V	The grid voltage has exceeded the max allowed value (276V).
E102 Weak Field V	The field voltage is too weak.
E103 Weak Field Power	The field power is too weak.
E104 PLL KO	The synchronisation with the grid has failed.
E105 Power Off	The inverter has turned off.
E106 Grid Synchronisation	Successful synchronisation with the grid.
E111 Failed Start	Too many consecutive start attempts.

Table 53: Description of the events

5.3. PARAMETERS MENU [PAR]

5.3.1. Description

The Parameters Menu allows accessing all the variables that can be modified to program the inverter, even when the inverter is in RUN mode.

Write Enable Menu and User Level Menu

The Write Enable menu allows editing the programming parameters, while the User Level menu allows selecting the user level for the programming.

PV Field Menu

The PV Field menu allows setting the parameters managing the inverter start, operating and stop procedures.

PV2 Field Menu (only if the Additional PV Field option is activated)

The PV2 Field menu allows adjusting the parameters relating to the Additional PV Field.

Counters Reset Menu

This menu allows resetting the event counters and the partial energy counters.

Grid Interface Self-Test Menu

This menu allows setting the parameters managing the Italian prescriptions for the connection to the LV grid.

Ambient Measures Menu

This menu allows selecting the type of analogue input and its scale factor.

Grid Interface Menu

This menu contains the operating parameters related to the three-phase grid.

Isolation Sensors Menu

This menu allows setting the parameters managing the resistance and the alarm for the isolation sensor of the PV field.

Multifunction Digital Output Menu

This menu allows setting the parameters managing the MDO4 digital output.

Clock/Calendar Menu (only if the Data Logger option is activated)

This menu allows setting the date and time (only available if the inverter is equipped with the Data Logger board).

Keypad Pages Menu

This menu allows setting the parameters managing the navigation modes in the display/keypad.

Energy Counters Menu

This menu contains the measures and parameters related to the Energy Count.

Data Logger Menu (only if the Data Logger option is activated)

This menu includes the measures and parameters to program the Data Logger board.

5.3.2. USER LEVEL MENU P001

The User Level menu allows selecting the user access level for the programming of the inverter parameters.

Parameter	Function	Access Level	Modbus Address
P001	User Level	BASIC	1457

Table 54: User access level set by P001

P001 User Level

P001	**Range**	0 ÷ 1	0: BASIC 1: ADVANCED
User Level	**Default**	0	0 : BASIC
	Level	BASIC	
	Address	1457	
	Function	The programming parameters of the inverter are divided into groups based on user access levels, depending on the complexity of their function. Therefore, based on the user level programmed in the display/keypad, the user is allowed to view only some menus or certain parts of them. As a consequence, by setting the BASIC user level, once the inverter is properly parameterized, navigation is easier, since the user is shown a shorter set of parameters that include only the ones most frequently used. In this Manual, for each parameter the preset user level is stated in the 'Level' field.	

5.3.3. FIELD MENU P020 ÷ P030

This submenu allows accessing the parameters for the adjustment of the inverter starting, the inverter operation in MPPT mode and the inverter stop.

The inverter enters in RUN mode when the field voltage value set in P020 is attained and maintained for the time set in P021.

The inverter stops when the power delivered to the grid is lower than P022 for a time equal to P024, or when the power delivered to the grid is lower than P023 for a time equal to P025.

The MPPT function is enabled via P026. The inverter refreshes the maximum power point according to the time interval set in P027, and it changes the MPPT reference by a voltage value set in P028.

Parameter	Function	Access Level	Modbus Address
P020	Field Voltage Reference, Manual MPPT	ADVANCED	620
P021	Min. Time for Radiation OK	ADVANCED	621
P022	Min. Power for Radiation KO	ADVANCED	622
P023	Min. Instantaneous Power for Radiation KO	ADVANCED	623
P024	Min. Power Radiation KO Time	ADVANCED	624
P025	Min. Instant. Power Radiation KO Time	ADVANCED	625
P026	MPPT Enable	ADVANCED	626
P027	MPPT Computing Cycle Time	ADVANCED	627
P028	MPPT Field Voltage Reference Variation	ADVANCED	628
P029	Module Vmpp/Voc Ratio	ADVANCED	629
P030	Fast MPPT Enhancement Factor	ADVANCED	630

Table 55: List of the parameters in the Field Menu P020 ÷ P030

P020 Field Voltage Reference, Manual MPPT

P020	**Size**	1300E	2600E-3600E-4300E	3600-4300-5300-6000-6400-7500-7800
	Range	105 ÷ 380 V	156 ÷ 540 V	260 ÷ 540 V
Field Voltage Reference, Manual MPPT	**Default**	190 V	260 V	300 V
	Level	ADVANCED		
	Address	620		
	Function	The inverter enters the RUN mode when the field voltage is higher than or equal to P020 and for the time set in **P021**. If the MPPT is disabled (**P026**=Inactive), **P020** is the (manual) reference for the Field voltage. NOTE: If the Additional Photovoltaic Field (PV2) is installed, the value set in P020 is limited to 103% of P037.		

P021 Min. Time for Radiation OK

P021	**Range**	0 ÷ 6000	0 ÷ 600.0 s
Min. Time for Radiation OK	**Default**	600	60.0 s
	Level	ADVANCED	
	Address	621	
	Function	Min time during which the open-circuit voltage of the PV field should exceed P020 to enable the inverter starting.	

P022 Min. Power for Radiation KO

P022	**Range**	0 ÷ 500	0 ÷ 500 W
Min. Power for Radiation KO	**Default**	50	50 W
	Level	ADVANCED	
	Address	622	
	Function	Min level for power delivery; if a power level lower than the min value (P022) is delivered, for a time equal to the Min. Power Radiation KO Time (P024), the equipment automatically disconnects and stops.	

P023 Min. Instantaneous Power for Radiation KO

P023	Range	500 ÷ 500	±500 W
Min. Instant. Power for Radiation KO	Default	0	0 W
	Level	ADVANCED	
	Address	623	
	Function	Min instantaneous level for power delivery; if a power level lower than P023 is delivered for a time equal to the Min. Instantaneous Power Radiation KO Time (P025), the equipment automatically disconnects and stops.	

P024 Min. Power Radiation KO Time

P024	Range	0 ÷ 60000	0 ÷ 6000.0 s
Min. Power Radiation KO Time	Default	2400	240.0 s
	Level	ADVANCED	
	Address	624	
	Function	Time for min power delivery; if the power delivered drops below the value set in P022 for a time at least equal to P024, the equipment automatically disconnects and stops.	

P025 Min. Instantaneous Power Radiation KO Time

P025	Range	0 ÷ 100	0 ÷ 10.0 s
Min. Instant. Power Radiation KO Time	Default	30	3.0 s
	Level	ADVANCED	
	Address	625	
	Function	Time for min. instantaneous power; if the power delivered drops below the value set in P023 for a time equal to P025, the equipment automatically disconnects and stops.	

P026 MPPT Enable

P026	Range	0 ÷ 1	0 : Inactive 1: Active
MPPT Enable	Default	1	1: Active
	Level	ADVANCED	
	Address	626	
	Function	MPPT enable: if P026 = Active, the MPPT algorithm is enabled. If P026 is set to ‘Inactive’, the MPPT function operates in manual mode and the field voltage reference is the value set in P020.	

P027 MPPT Computing Cycle Time

P027	Range	1 ÷ 300	0.1 ÷ 30.0 s
MPPT Computing Cycle Time	Default	20	2.0 s
	Level	ADVANCED	
	Address	627	
	Function	In Automatic MPPT mode (P026 = Active), this parameter sets the time period when the field voltage reference is kept constant. When the time set is over, the algorithm for MPPT computing is performed again.	

P028 MPPT Field Voltage Reference Variation

P028	Range	10 ÷ 1000	0.10 ÷ 10.00 V
MPPT Field Voltage Reference Variation	Default	150	1.50 V
	Level	ADVANCED	
	Address	628	
	Function	In Automatic MPPT mode, this parameter sets the increment/decrement of the field voltage reference used between two consecutive cycles of the algorithm for the computing of the maximisation of power delivery.	

P029 Module Vmp/Voc Ratio

P029	Range	50 ÷ 100	50 ÷ 100 %
Module Vmp/Voc Ratio	Default	90	90 %
	Level	ADVANCED	
	Address	629	
	Function	If the MPPT function is enabled (P026=Activated), **P029** is the starting value – with respect to the open-circuit voltage – for the MPPT algorithm. Example: if Voc= 450V and P029 = 90%, when the START command is sent, the inverter starts the MPPT search from 405V. This parameter can be enhanced based on the type of panels installed by calculating the Vmp/Voc ratio, where Vmp is the rated voltage and Voc is the open-circuit voltage of the panels.	

P030 Fast MPPT Enhancement Factor

P030	Range	10 ÷ 50	1.0 ÷ 5.0
Fast MPPT Enhancement	Default	20	2.0
	Level	ADVANCED	
	Address	630	
	Function	The SUNWAY M PLUS implements an enhanced MPPT algorithm capable of modifying the MPPT rate based on the work point. If the field voltage is close to the Vmp, the inverter uses standard tracking steps (**P028** and **P027**), thus ensuring extreme accuracy. On the other hand, if the field voltage is remarkably different from Vmp, the inverter increases the voltage steps and the frequency by a factor equal to **P030**, thus increasing the efficacy of the MPPT algorithm.	

5.3.4. PV2 FIELD MENU P300 ÷ P307

This submenu includes the parameters used to adjust the operation of the Additional PV Field (PV2).

Based on the configuration of the Main Field and the Additional Field, the power available from PV2 is delivered to the grid when the field voltage value set in P300 and increased by 10% is attained and maintained for the time set in P301.

The MPPT function is enabled via P302. The inverter refreshes the maximum power point at a time interval set by P303, and it modifies the MPPT reference by a voltage value set in P304.

This menu is available only if the PV2 Field option is fitted and enabled (C007).

Parameter	Function	Access Level	Modbus Address
P300	PV2 Field Voltage Reference, Manual MPPT	ADVANCED with PV2	900
P301	Min. Time for Radiation OK	ADVANCED with PV2	901
P302	PV2 MPPT Enable	ADVANCED with PV2	*902*
P303	MPPT Computing Cycle Time for PV2	ADVANCED with PV2	903
P304	MPPT Field Voltage Reference Variation for PV2	ADVANCED with PV2	904
P306	Min. Field Voltage Reference MPPT2	ADVANCED with PV2	906
P307	Max. Field Voltage Reference MPPT2	ADVANCED with PV2	907

Table 56: List of the parameters of the PV2 Field Menu P300 ÷ P307

P300 PV2 Field Voltage Reference, Manual MPPT

P300	**Size**	2600E-3600E-4300E	3600-4300-5300-6000-6400-7500-7800
	Range (default)	24 ÷ 360 V	24 ÷ 486 V
PV2 Field Voltage Reference, Manual MPPT	**Range**	P306 ÷ P307	P306 ÷ P307
	Default	112 V	168 V
	Level	ADVANCED	
	Active	This parameter is displayed only if the PV2 field option is present (C007 = 1: PV2 Only, or 2: PV1 + PV2).	
	Address	900	
	Function	If the PV2 MPPT is enabled (**P302** = Active), **P300** represents the start value of the PV2 Field voltage reference for the maximum power point tracking function. If the PV2 MPPT is disabled (**P302** =Inactive), **P300** represents the manual reference of the PV2 Field voltage. Unless radiation for the main field is enough to maintain power delivery, the inverter enters the RUN mode if the PV2 Field voltage is higher than or equal to P300*1.10 for a time equal to **P301**. **NOTE**: The start and end values for the interval of **P300** are set by **P306** and **P307**.	

P301 Min. Time for Radiation OK

P301	**Range**	0 ÷ 6000	0 ÷ 600.0 s
Min. Time for Radiation OK	**Default**	600	60.0 s
	Level	ADVANCED	
	Active	This parameter is displayed only if the PV2 field option is present (C007 = 1: PV2 Only, or 2: PV1 + PV2).	
	Address	901	
	Function	Min time during which the open-circuit voltage of the PV field should exceed P301*1.10 to enable the inverter starting.	

P302 PV2 MPPT Enable

P302	Range	0 ÷ 1	0 : Inactive 1: Active
PV2 MPPT Enable	Default	1	1: Active
	Level	ADVANCED	
	Active	This parameter is displayed only if the PV2 field option is present (C007 = 1: PV2 Only, or 2: PV1 + PV2).	
	Address	902	
	Function	MPPT enable: if P302 = Active, the MPPT algorithm is enabled and P300 is the field voltage value from which the MPPT search starts. If P302 is set to “Inactive”, the MPPT function operates in manual mode and the field voltage reference is the value set in P300.	

P303 MPPT Computing Cycle Time for PV2

P303	Range	0 ÷ 300	0 ÷ 30.0 s
MPPT Computing Cycle Time for PV2	Default	20	2.0 s
	Level	ADVANCED	
	Active	This parameter is displayed only if the PV2 field option is fitted in the inverter (C007 = 1: PV2 Only, or 2: PV1 + PV2).	
	Address	903	
	Function	In Automatic MPPT mode (P302 = Active), this parameter sets the time period in which the field voltage reference is kept constant. When the time set is over, the algorithm for MPPT computing is performed again.	

P304 MPPT Field Voltage Reference Variation for PV2

P304	Range	10 ÷ 1000	0.10 ÷ 10.00 V
MPPT Field Voltage Reference Variation for PV2	Default	150	1.50 V
	Level	ADVANCED	
	Active	This parameter is displayed only if the PV2 field option is fitted in the inverter (C007 = 1: PV2 Only, or 2: PV1 + PV2).	
	Address	904	
	Function	In Automatic MPPT mode, this parameter sets the increment/decrement of the field voltage reference used between two consecutive cycles of the algorithm for the computing of the maximisation of power delivery.	

P306 Min. Field Voltage Reference MPPT2

P306	Range	24 ÷ 300	24 ÷ 300 V
Min. Field Voltage Reference MPPT2	Default	24	
	Level	ADVANCED	
	Active	This parameter is displayed only if the PV2 field option is present (C007 = 1: PV2 Only, or 2: PV1 + PV2).	
	Address	906	
	Function	In Automatic MPPT mode, this is the min value of the field voltage reference.	

P307 Max. Field Voltage Reference MPPT2

P307	Range	100 ÷ 486	100 ÷ 486 V
Max. Field Voltage Reference MPPT2	Default	360	
	Level	ADVANCED	
	Active	This parameter is displayed only if the PV2 field option is present (C007 = 1: PV2 Only, or 2: PV1 + PV2).	
	Address	907	
	Function	In Automatic MPPT mode, this is the max value of the field voltage reference. **NOTE:** The whole submenu, and therefore the parameter are displayed only if the PV2 option is fitted in the inverter and if C007 = 1: PV2 Only, or 2: PV1 + PV2.	

5.3.5. COUNTERS RESET MENU I002 ÷ I007

The Counter Reset includes the commands to reset the event counters and the partial energy delivery counter.

Parameter	Function	Access Level	Modbus Address
I002	Partial Active Energy Counter Reset	BASIC	1389
I003	Grid KO Events Counter Reset	ADVANCED	1390
I004	Radiation KO Events Counter Reset	ADVANCED	1391
I005	Active Energy Counter Reset	ADVANCED	1392
I007	Delivery Time Reset	ADVANCED	1394

Table 57: List of the parameters in the Counters Reset Menu I002 ÷ I007

I002 Partial Active Energy Counter Reset

I002	**Range**	0 ÷ 1	0: Inactive 1: Active
Partial Active Energy Counter Reset	**Default**	0	0: Inactive
	Level	ADVANCED	
	Address	1389	
	Function	This parameter allows resetting the counter for the partial active energy (M011).	

I003 Grid KO Events Counter Reset

I003	**Range**	0 ÷ 1	0: Inactive 1: Active
Grid KO Events Counter Reset	**Default**	0	0: Inactive
	Level	ADVANCED	
	Address	1390	
	Function	This parameter allows resetting the counter for grid failure events (M015).	

I004 Radiation KO Events Counter Reset

I004	**Range**	0 ÷ 1	0: Inactive 1: Active
Radiation KO Events Counter Reset	**Default**	0	0: Inactive
	Level	ADVANCED	
	Address	1391	
	Function	This parameter allows resetting the counter for the events of ‘no solar radiation’ (M016).	

I005 Active Energy Counter Reset

I005	**Range**	0 ÷ 1	0: Inactive 1: Active
Active Energy Counter Reset	**Default**	0	0: Inactive
	Level	ADVANCED	
	Address	1392	
	Function	This parameter allows resetting the active energy counter (M010).	

I007 Power Delivery Time Reset

I007	**Range**	0 ÷ 1	0: Inactive 1: Active
Power Delivery Time Reset	**Default**	0	0: Inactive
	Level	ADVANCED	
	Address	1394	
	Function	This parameter allows resetting the counter of the power delivery time (M097).	

5.3.6. GRID INTERFACE SELF-TEST MENU I030 ÷ I033

This menu allows performing the operating checks on the grid disconnection device (the 'interface protection') as required by the Grid Administrator. To perform the check, the inverter must be in RUN mode.

Parameter	Function	Access Level	Modbus Address
I030	Test for Min. Grid Voltage Trip Threshold	ADVANCED	1417
I031	Test for Max. Grid Voltage Trip Threshold	ADVANCED	1418
I032	Test for Min. Grid Frequency Trip Threshold	ADVANCED	1419
I033	Test for Max. Grid Frequency Trip Threshold	ADVANCED	1420

Table 58: List of the parameters in the Grid Interface Self-Test menu I030 ÷ I033

I030 Test for Min. Grid Voltage Trip Threshold

I030	**Range**	0 ÷ 1	0: Inactive 1: Active
Test for Min. Grid Voltage Trip Threshold	**Default**	0	0: Inactive
	Level	ADVANCED	
	Address	1417	
	Function	This parameter allows testing the disconnection threshold of the grid interface protection device due to a min voltage condition, as prescribed by the Italian regulations applying to LV grid connection.	

I031 Test for Max. Grid Voltage Trip Threshold

I031	**Range**	0 ÷ 1	0: Inactive 1: Active
Test for Max. Grid Voltage Trip Threshold	**Default**	0	0: Inactive
	Level	ADVANCED	
	Address	1418	
	Function	This parameter allows testing the disconnection threshold of the grid interface protection device due to a max. voltage condition, as prescribed by the Italian regulations applying to LV grid connection.	

I032 Test for Min. Grid Frequency Trip Threshold

I032	**Range**	0 ÷ 1	0: Inactive 1: Active
Test for Min. Grid Frequency Trip Threshold	**Default**	0	0: Inactive
	Level	ADVANCED	
	Address	1419	
	Function	This parameter allows testing the disconnection threshold of the grid interface protection device due to a min. frequency condition, as prescribed by the Italian regulations applying to LV grid connection.	

I033 Test for Max. Grid Frequency Trip Threshold

I033	**Range**	0 ÷ 1	0: Inactive 1: Active
Test for Max. Grid Frequency Trip Threshold	**Default**	0	0: Inactive
	Level	ADVANCED	
	Address	1420	
	Function	This parameter allows testing the disconnection threshold of the grid interface protection device due to a max. frequency condition, as prescribed by the Italian regulations applying to LV grid connection.	

5.3.7. AMBIENT MEASURES MENU P050 ÷ P064 (P320 ÷ P354)

This menu contains the parameters used to select the type of analogue input and its scale factor.

The units of measure of the ambient variables acquired directly from the control board are the following: ambient measure 1 is for solar radiation, ambient measure 2 is for the module temperature and ambient measure 3 is for ambient temperature.

After selecting the type of sensor to be used, proceed as follows:

- Set the acquisition mode of the sensor (0÷10 V, 4÷20 mA o 0÷20 mA) and set the relevant dip-switch as required (see section 4.1.1 Configuration DIP-Switches);
- Set an OFFSET, if required;
- Set a filter in the measure channel, if required;
- Set the min value of the ambient measure corresponding to the min value of the input signal for the measuring channel;
- Set the full-scale value of the ambient measure corresponding to the max value of the measuring channel.

For example, if a solar radiation sensor is used, which delivers 4mA when solar radiation is 0 and 20mA at 1200W/m², proceed as follows:

- Set 4÷20 mA in P050 and set SW1-1 to ON;
- Generally, it is not necessary to set P051 and P052;
- Set 0 in P053;
- Set 1200 in P054.

Parameter	Function	Access Level	Modbus Address
P050	Ambient Measure 1 Mode	ADVANCED	650
P051	Ambient Measure 1 Offset	ADVANCED	651
P052	Ambient Measure 1 Filter Time Constant	ADVANCED	652
P053	Min. Value of Ambient Measure 1	ADVANCED	653
P054	Full-scale value of Ambient Measure 1	ADVANCED	654
P055	Ambient Measure 2 Mode	ADVANCED	655
P056	Ambient Measure 2 Offset	ADVANCED	656
P057	Ambient Measure 2 Filter Time Constant	ADVANCED	657
P058	Min. Value of Ambient Measure 2	ADVANCED	658
P059	Full-scale value of Ambient Measure 2	ADVANCED	659
P060	Ambient Measure 3 Mode	ADVANCED	660
P061	Ambient Measure 3 Offset	ADVANCED	661
P062	Ambient Measure 3 Filter Time Constant	ADVANCED	662
P063	Min. Value of Ambient Measure 3	ADVANCED	663
P064	Full-scale value of Ambient Measure 3	ADVANCED	664

Table 59: List of the parameters in the Ambient Measure menu P050 ÷ P064

NOTE

If the Additional PV Field option (PV2) is installed, ambient measures 1, 2 and 3 are not available.

P050 Ambient Measure 1 Mode

P050	**Range**	0 ÷ 3	0: no input 1: val 0 ÷ 10 V 2: val 0 ÷ 20 mA 3: val 4 ÷ 20 mA
Type of Signal on REF Input	**Default**	0	0: no input
	Level	ADVANCED	
	Address	650	
	Function	This parameter selects the type of single-ended analogue signal of the REF input in the terminal board. Signals can be current signals or voltage signals, but they can be unipolar signals only. **0**: Signal is not used. By setting this value, the measures in the Measure menu and 'P' parameters related to the analogue input are not displayed. **1**: 0 ¸ 10 V Unipolar voltage input; the detected signal is saturated between 0V and +10V. **2**: 0 ¸ 20 mA Unipolar current input; the detected signal is saturated between +0 mA and +20mA. **3**: 4 ¸ 20 mA Unipolar current input with minimum threshold; the detected signal is saturated between +4 mA and +20mA.	

NOTA

The value of parameter P050 must be consistent with the status of switch SW1–1, which allows selecting the proper electric circuit for the processing of the analogue signal (voltage signal or current signal).

P051 Ambient Measure 1 Offset

P051	**Range**	–5000 ÷ +5000	-50.00 ÷ +50.00
Offset Correction Value for REF Input	**Default**	0	0
	Level	ADVANCED	
	Address	651	
	Function	This parameter selects the correction value of the offset for the REF analogue signal being measured. The set value is summed up to the measured value before saturation or table-conversion.	

P052 Ambient Measure 1 Filter Time Constant

P052	Range	1 ÷ 30000	0.01 ÷ 30.00 s
REF Filter Time Constant	Default	1	0.01s
	Level	ADVANCED	
	Address	652	
	Function	This parameter allows selecting the value of the filter time constant of the first order, which is applied to the REF input signal at the end of the signal saturation/conversion process.	

P053: Min. Value of Ambient Measure 1

P053	Range	-30000 ÷ +30000	-3000.0 ÷ +3000 W/m^2
Min. Value of Ambient Measure 1	Default	0	0.0 W/m2
	Level	ADVANCED	
	Address	653	
	Function	Min. value of the variable corresponding to the min. input value to ambient measure 1, as set in **P050** (0V or 0mA or 4mA).	

P054: Full-scale Value of Ambient Measure 1

P054	Range	0 ÷ 30000	0 ÷ 3000.0 W/m^2
Full-scale Value of Ambient Measure 1	Default	10000	1000.0 W/m2
	Level	ADVANCED	
	Address	654	
	Function	Max. value of the variable corresponding to the max. input value to ambient measure 1, as set in **P050** (10V or 20mA).	

P055 Ambient Measure 2 Mode

P055	**Range**	0 ÷ 3	0: no input 1: val 0 ÷ 10 V 2: val 0 ÷ 20 mA 3: val 4 ÷ 20 mA
Type of Signal on AIN1 Input	**Default**	0	0: no input
	Level	ADVANCED	
	Address	655	
	Function	This parameter allows selecting the type of differential analogue signal on the AIN1 input in the terminal board. The signal can be a current signal or a voltage signal. **0:** The signal is not used. By setting this value, the measures in the Measure menu and the 'P' parameters related to the analogue input are not displayed. **1**: 0 ¸ 10 V Voltage input between 0V and +10V; the detected signal is saturated between these two values. **2**: 0 ¸ 20 mA Current input between +0 mA and +20mA; the detected signal is saturated between these values. **3**: 4 ¸ 20 mA Current input with minimum threshold between +4 mA and +20mA; the detected signal is saturated between these two values.	

NOTE

*The value of parameter **P055** must be consistent with the status of switch **SW1–2**, which allows selecting the proper electric circuit for the processing of the analogue signal (voltage signal or current signal).*

P056 Ambient Measure 2 Offset

P056	**Range**	–5000 ÷ +5000	-50.00 ÷ +50.00
Offset Correction Value on AIN1 Input	**Default**	0	0
	Level	ADVANCED	
	Address	656	
	Function	This parameter selects the correction value of the offset for the AIN1 analogue signal that is being measured. The set value is summed up to the detected value before saturation or table-conversion.	

P057 Ambient Measure 2 Filter Time Constant

P057	Range	1 ÷ 30000	0.01 ÷ 30.00 s
AIN1 Filter Time Constant	Default	1	0.01s
	Level	ADVANCED	
	Address	657	
	Function	This parameter allows selecting the value of the filter time constant of the first order applied to the AIN1 input signal at the end of the signal saturation/conversion process.	

P058 Min. Value of Ambient Measure 2 (Modules Temperature)

P058	Range	-30000 ÷ +30000	-3000.0 ÷ +3000.0 °C
Min. Value of Ambient Measure 2	Default	0	0.0 °C
	Level	ADVANCED	
	Address	658	
	Function	Min. value of the variable corresponding to the min. input value to ambient measure 2, as set in P055 (0V or 0mA or 4mA).	

P059 Full-scale Value of Ambient Measure 2

P059	Range	0 ÷ +30000	0 ÷ +3000.0 °C
Full-scale Value of Ambient Measure 2	Default	1000	100.0 °C
	Level	ADVANCED	
	Address	659	
	Function	Max. value of the variable corresponding to the max. input value to ambient measure 2, as set in P055 (10V or 20mA).	

P060 Ambient Measure 3 Mode

P060	**Range**	0 ÷ 3	0: no input 1: val 0 ÷ 10 V 2: val 0 ÷ 20 mA 3: val 4 ÷ 20 mA
Type of Signal on AIN2 Input	**Default**	0	0: no input
	Level	ADVANCED	
	Address	660	
	Function	This parameter allows selecting the type of differential analogue signal on the AIN2 input in the terminal board. The signal can be a current signal or a voltage signal. **0**: The signal is not used. By setting this value, the measures in the Measure menu and the 'P' parameters related to the analogue input are not displayed. **1**: 0 ¸ 10 V Voltage input between 0V and +10V; the detected signal is saturated between these two values. **2**: 0 ¸ 20 mA Current input between +0 mA and +20mA; the detected signal is saturated between these values. **3**: 4 ¸ 20 mA Current input with minimum threshold between +4 mA and +20mA; the detected signal is saturated between these two values.	

NOTE

*The value of parameter **P060** must be consistent with the status of switch **SW1–3**, which allows selecting the proper electric circuit for the processing of the analogue signal (voltage signal or current signal).*

P061 Ambient Measure 3 Offset

P061	**Range**	–5000 ÷ +5000	-50.00 ÷ +50.00
Offset Correction Value on AIN2 Input	**Default**	0	0
	Level	ADVANCED	
	Address	661	
	Function	This parameter allows selecting the correction value of the offset for the AIN2 analogue input being measured. The set value is summed up to the detected value before saturation or table-conversion.	

P062 Ambient Measure 3 Filter Time Constant

P062	Range	1 ÷ 30000	0.01 ÷ 30.00 s
AIN2 Filter Time Constant	Default	1	0.01 s
	Level	ADVANCED	
	Address	662	
	Function	This parameter allows selecting the value of the filter time constant of the first order applied to the AIN2 input signal at the end of the signal saturation/conversion process.	

P063: Min. Value of Ambient Measure 3 (Ambient Temperature)

P063	Range	-30000 ÷ +30000	-3000.0 ÷ +3000.0 °C
Min. Value of Ambient Measure 3	Default	0	0.0 °C
	Level	ADVANCED	
	Address	663	
	Function	Min. value of the variable corresponding to the min. input value of ambient measure 3, as set in P060 (0V or 0mA or 4mA).	

P064: Full-scale Value of Ambient Measure 3

P064	Range	0 ÷ +30000	0 ÷ +3000.0 °C
Full-scale Value of Ambient Measure 3	Default	1000	100.0 °C
	Level	ADVANCED	
	Address	664	
	Function	Max. value of the variable corresponding to the max. input value of ambient measure 3, as set in P060 (10V or 20mA).	

5.3.7.1. Ambient Measures Expansion Menu P320 ÷ P354

If the Ambient Sensors and Field I/O Expansion Board (option) is active, the Ambient Measures Menu also contains the relevant programming parameters.

The six analogue inputs of the board allow connecting special measuring sensors to the inverter. Thus, the expanded menu includes the parameters required for setting the type of sensor, the type of variable to be measured and its scale factor.

The first four channels are fully configurable, whereas the last two channels are factory-set to 0¸ 10V.

The programming procedure is similar to the programming of parameters P050÷P064, with the only difference that the filter time constant for the ambient measures on the board is set to 1 second and cannot be changed.

Standard ambient measures and programmable ambient measures

The 'standard' ambient measures are the factory-set measures, according to the table below:

Standard Ambient Measure	Unit of Measure	F.S.	Modbus Address
1 – Module radiation	[Wm^2]	0.0 - 1000.0	3218
2 – Horizontal radiation	[Wm^2]	0.0 - 1000.0	3219
3 – Ambient temperature	[°C]	-50.0 - 125.0	3220
4 – Module temperature	[°C]	-50.0 - 125.0	3221
5 – Wind direction	[°] (degrees)	-360.0 - 360.0	3222
6 – Wind speed	[m/s]	0 – 100.0	3223

Table 60: List of the parameters for the standard ambient measures

When the settings of one or more parameters for standard ambient measures are modified by the user, their Modbus addresses are changed accordingly as follows:

Generic Ambient Measure	Modbus Address
1	1674
2	1675
3	1676
4	1677
5	1678
6	1679

Table 61: Addresses of generic ambient measures

Parameter	Function	Access Level	Modbus Address
P320	Type of Signal on the AIN4 Input	ADVANCED	920
P321	Offset Correction Value for the AIN4 Input	ADVANCED	921
P322	Measure Selected on the AIN4 Input	ADVANCED	922
P323	Min. Value of Measure Selected on the AIN4 Input	ADVANCED	923
P324	Full-scale value of Measure Selected on the AIN4 Input	ADVANCED	924
P326	Type of Signal on the AIN5 Input	ADVANCED	926
P327	Offset Correction Value for the AIN5 Input	ADVANCED	927
P328	Measure Selected on the AIN5 Input	ADVANCED	928
P329	Min. Value of Measure Selected on the AIN5 Input	ADVANCED	929
P330	Full-scale value of Measure Selected on the AIN5 Input	ADVANCED	930
P332	Type of Signal on the AIN6 Input	ADVANCED	932
P333	Offset Correction Value for the AIN6 Input	ADVANCED	933
P334	Measure Selected on the AIN6 Input	ADVANCED	934
P335	Min. Value of Measure Selected on the AIN6 Input	ADVANCED	935
P336	Full-scale value of Measure Selected on the AIN6 Input	ADVANCED	936
P338	Type of Signal on the AIN7 Input	ADVANCED	938
P339	Offset Correction Value for the AIN7 Input	ADVANCED	939
P340	Measure Selected on the AIN7 Input	ADVANCED	940
P341	Min. Value of Measure Selected on the AIN7 Input	ADVANCED	941
P342	Full-scale value of Measure Selected on the AIN7 Input	ADVANCED	942
P344	Type of Signal on the AIN8 Input	ADVANCED	944
P345	Offset Correction Value for the AIN8 Input	ADVANCED	945
P346	Measure Selected on the AIN8 Input	ADVANCED	946
P347	Min. Value of Measure Selected on the AIN8 Input	ADVANCED	947
P348	Full-scale value of Measure Selected on the AIN8 Input	ADVANCED	948
P350	Type of Signal on the AIN9 Input	ADVANCED	950
P351	Offset Correction Value for the AIN9 Input	ADVANCED	951
P352	Measure Selected on the AIN9 Input	ADVANCED	952
P353	Min. Value of Measure Selected on the AIN9 Input	ADVANCED	953
P354	Full-scale value of Measure Selected on the AIN9 Input	ADVANCED	954

Table 62: List of the programmable parameters P320 ÷ P354

Each of the six ambient measures can be acquired by external devices and sent to the inverter via the serial link and Modbus protocol. The 'Ambient Measure Mode' parameters can be used to acquire an ambient measure from an external device; the operating mode to be selected is Mode 6: EXTERNAL Measure.

The numeric values acquired are processed as decimal numbers with one decimal digit. For example, 12345 is acquired as 1234.5 and allocated as such to the corresponding measure.

The Modbus addresses for the external ambient measures are listed below.

Parameter	Function	Access Level	Modbus Address
I022	External Ambient Measure 1	BASIC	1409
I025	External Ambient Measure 2	BASIC	1412
I026	External Ambient Measure 3	BASIC	1413
I027	External Ambient Measure 4	BASIC	1414
I029	External Ambient Measure 5	BASIC	1416
I034	External Ambient Measure 6	BASIC	1421

Table 63: List of the Modbus addresses for the external ambient measures

P320-P326-P332-P338-P344-P350 Ambient Measure Modes

P320 for AIN4 **P326 for AIN5** **P332 for AIN6** **P338 for AIN7** **P344 for AIN8** **P350 for AIN9**	**Range**	0 ÷ 6	Ambient Measure AIN4, AIN5, AIN6, AIN7: 0: Channel Disabled 1: 0 ÷ 10 V 2: 0 ÷ 20 mA 3: 4 ÷ 20 mA 4: 0 ÷ 100 mV 5: PT100 6: EXTERNAL Measure Ambient Measure AIN8, AIN9: 0: Channel Disabled 1: 0 ÷ 10 V 6: EXTERNAL Measure
Ambient Measure Mode	**Default**	0	0: Channel Disabled
	Level	ADVANCED	
	Active	This parameter can be viewed only if the Ambient Sensor and Field I/Os Expansion Board is active.	
	Address	920-926-932-938-944-950	
	Function	These parameters allow selecting the type of analogue signal on the AIN4-9 terminals in the terminal board of the Ambient Sensor and Field I/Os Expansion Board. Signals in channels AIN4 to AIN7 can be current signals, voltage signals or PT100 signals. Channels AIN8 and AIN9 can receive 0÷10V signals only. **0**: Channel disabled. **1**: 0 ¸ 10 V Unipolar voltage input; the detected signal is saturated between 0V and +10V. **2**: 0 ¸ 20 mA Unipolar current input; the detected signal is saturated between +0 mA and +20mA. **3**: 4 ¸ 20 mA Unipolar current input with minimum threshold; the detected signal is saturated between +4 mA and +20mA. **4**: **0** ¸ 100mV Unipolar voltage input; the detected signal is saturated between 0V and +100mV. **5**: PT100. The resistance of the PT100 probe is measured. **6**: EXTERNAL ambient measure.	

NOTE

The values of the parameters above must be consistent with the status of the switches located on the Ambient Sensors and Field I/Os Expansion Board, which allow selecting the proper electric circuit for the processing of the analogue signal (voltage signal or current signal).

P321-P327-P333-P339-P345-P351 Offset Correction Value on the AIN4-9 Inputs

P321 for AIN4 P327 for AIN5 P333 for AIN6 P339 for AIN7 P345 for AIN8 P351 for AIN9	**Range**	–30000 ÷ 30000	-3000.0 ÷ 3000.0: if Ambient Measure Mode = 4-5 -300.00 ÷ 300.00: if Ambient Measure Mode = 1-2-3 n.a. : if Ambient Measure Mode = 6
Offset Correction Value on the AIN4-9 Inputs	**Default**	0	0 V
	Level	ADVANCED	
	Active	This parameter can be viewed only if the Ambient Sensor and Field I/Os Expansion Board is active.	
	Address	921-927-933-939-945-951	
	Function	These parameters allow selecting the value of the offset correction of the analogue signal measured on the inputs AIN4-9. The preset value is summed up to the measured value before saturation or table-conversion.	

P322-P328-P334-P340-P346-P352: Selection of the Ambient Measures 4-9

P322 for AIN4 P328 for AIN5 P334 for AIN6 P340 for AIN7 P346 for AIN8 P352 for AIN9	**Range**	0 ÷ 21	See Table 64
Selection of Ambient Measures 4-9	**Default**	1 for AIN4	Solar radiation
		1 for AIN5	Solar radiation
		4 for AIN6	Temperature (PT100 probe)
		4 for AIN7	Temperature (PT100 probe)
		11 for AIN8	Wind direction
		14 for AIN9	Wind speed
	Level	ADVANCED	
	Active	This parameter can be viewed only if the Ambient Sensor and Field I/Os Expansion Board is active.	
	Address	922-928-934-940-946-952	
	Function	Selection of the type of variable to be applied to the analogue channels AIN4-9.	

Encoding of the Measures	
Value of the Selection and Description	**Unit of Measure**
0: General ambient measure	
1: Solar radiation	[Wm^2]
2: Solar radiation upon flat modules	[Wm^2]
3: Solar radiation upon horizontal modules	[Wm^2]
4: Temperature 1	[°C]
5: Temperature 2	[°F]
6: Module temperature 1	[°C]
7: Module temperature 2	[°F]
8: Ambient temperature 1	[°C]
9: Ambient Temperature 2	[°F]
10: Direction	[°]
11: Wind direction	[°]
12: Speed 1	[m/s]
13: Speed 2	[rpm]
14: Wind speed	[m/s]
15: Pressure 1	[bar]
16: Pressure 2	[atmosphere]
17: Capacity 1	[mcs]
18: Capacity 2	[mch]
19: Displacement	[m]
20: Torque	[Nm]
21: Percentage	[%]

Table 64: List of the variables that can be selected as ambient measures

P324-P330-P336-P342-P348-P354: Min. Value of Ambient Measures 4-9

P324 for AIN4 P330 for AIN5 P336 for AIN6 P342 for AIN7 P348 for AIN8 P354 for AIN9	**Range**	–30000 ÷ +30000	–3000,0 ÷ +3000,0 MΩ
Min. Value of Ambient Measures 4-9	**Default**	0	0
	Level	ADVANCED	
	Active	This parameter can be viewed only if the Ambient Sensor and Field I/Os Expansion Board is active.	
	Address	924-930-936-942-947-953	
	Function	Minimum value of the variable corresponding to the min. input value for AIN4-9.	

P323-P329-P335-P341-P347-P353: Full-scale Values for Ambient Measures 4-9

P323 per AIN4 P329 per AIN5 P335 per AIN6 P341 per AIN7 P347 per AIN8 P353 per AIN9	**Range**	0 ÷ +30000	0,0 ÷ +3000,0 MΩ
Full-scale Values for Ambient Measures 4-9	**Default**	10000 for AIN4, AIN5, AIN8 and AIN9 1250 per AIN6, AIN7	1000,0 for AIN4, AIN5, AIN8 and AIN9 125,0 for AIN6, AIN7
	Level	ADVANCED	
	Active	This parameter can be viewed only if the Ambient Sensor and Field I/Os Expansion Board is active.	
	Address	925-931-937-943-948-954	
	Function	Maximum value of the variable corresponding to the max. input value for AIN4-9.	

5.3.8. GRID INTERFACE MENU P080 ÷ P122

This submenu allows accessing the equipment operating parameters relating to the 3-phase grid. The default values of these parameters ensure the correct operation of the interface protection device in compliance with the national standard for the connection to the LV grid. Any variation to these parameters must be agreed upon with and authorised by the Grid Administrator, only after a proper checking of the new functionality.

Parameter	Function	Access Level	Modbus Address
P080	Instantaneous Overvoltage Threshold	See “Certification and Grid Interface File”	680
P081	Inst. Overvoltage Release Ratio	See “Certification and Grid Interface File”	681
P082	Inst. Overvoltage Trip Time	See “Certification and Grid Interface File”	682
P083	Inst. Overvoltage Reset Time	See “Certification and Grid Interface File”	683
P084	MAX. Voltage Trip Threshold	See “Certification and Grid Interface File”	684
P085	MAX. Voltage Release Ratio	See “Certification and Grid Interface File”	685
P086	MAX. Voltage Trip Time	See “Certification and Grid Interface File”	686
P087	MAX. Voltage Reset Time	See “Certification and Grid Interface File”	687
P088	Min. Voltage Trip Threshold	See “Certification and Grid Interface File”	688
P089	Min. Voltage Release Ratio	See “Certification and Grid Interface File”	689
P090	Min. Voltage Trip Time	See “Certification and Grid Interface File”	690
P091	Min. Voltage Reset Time	See “Certification and Grid Interface File”	691
P092	Instantaneous Undervoltage Threshold	See “Certification and Grid Interface File”	692
P093	Inst. Undervoltage Release Ratio	See “Certification and Grid Interface File”	693

Parameter	Function	Access Level	Modbus Address
P094	Inst. Undervoltage Trip Time	See “Certification and Grid Interface File”	694
P095	Inst. Undervoltage Reset Time	See “Certification and Grid Interface File”	695
P096	MAX. Frequency Trip Threshold	See “Certification and Grid Interface File”	696
P097	MAX. Frequency Release Ratio	See “Certification and Grid Interface File”	697
P098	MAX. Frequency Trip Time	See “Certification and Grid Interface File”	698
P099	MAX. Frequency Reset Time	See “Certification and Grid Interface File”	699
P100	Min. Frequency Trip Threshold	See “Certification and Grid Interface File”	700
P101	Min. Frequency Release Ratio	See “Certification and Grid Interface File”	701
P102	Min. Frequency Trip Time	See “Certification and Grid Interface File”	702
P103	Min. Frequency Reset Time	See “Certification and Grid Interface File”	703
P104	MAX. Frequency Derivative Trip Threshold	See “Certification and Grid Interface File”	704
P105	MAX. Frequency Derivative Release Ratio	See “Certification and Grid Interface File”	705
P106	MAX. Frequency Derivative Trip Time	See “Certification and Grid Interface File”	706
P107	MAX. Frequency Derivative Reset Time	See “Certification and Grid Interface File”	707
P122	Average Overvoltage Threshold	See “Certification and Grid Interface File”	722

Table 65: List of the parameters P080÷P122

P080 Instantaneous Overvoltage Threshold

P080	Range	130 ÷ 160	130 ÷ 160 %
Instantaneous Overvoltage Threshold	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	680	
	Function	This parameter is expressed as a percentage of the rated grid voltage; it sets the trip threshold for the Grid Overvoltage fault.	

P081 Inst. Overvoltage Release Ratio

P081	Range	950 ÷ 1000	0.95 ÷ 1
Inst. Overvoltage Release Ratio	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	681	
	Function	This parameter sets the ratio between the trip voltage value for the Overvoltage fault and the value at which it is reset.	

P082 Inst. Overvoltage Trip Time

P082	Range	1 ÷ 1000	0.001 ÷ 1.000 s
Inst. Overvoltage Trip Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	682	
	Function	This is the time during which the instantaneous overvoltage trip condition must be maintained to prompt the activation of the grid Overvoltage fault.	

P083 Inst. Overvoltage Reset Time

P083	Range	1 ÷ 1000	0.001 ÷ 1.000 s
Inst. Overvoltage Reset Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	683	
	Function	This is the time during which the instantaneous overvoltage reset condition must be maintained to prompt the deactivation of the grid Overvoltage fault.	

P084 Max. Voltage Trip Threshold

P084	Range	105 ÷ 130	105 ÷ 130 %
Max. Voltage Trip Threshold	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	684	
	Function	This parameter is expressed as a percentage of the rated grid voltage; it sets the trip threshold for the grid Max. Voltage fault.	

P085 Max. Voltage Release Ratio

P085	Range	900 ÷ 1000	0.900 ÷ 1.000
Max. Voltage Release Ratio	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	685	
	Function	This parameter sets the ratio between the trip voltage value for the Max. Voltage fault and the value at which it is reset.	

P086 Max. Voltage Trip Time

P086	Range	20 ÷ 1000	0.020 ÷ 1.000 s
Max. Voltage Trip Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	686	
	Function	This is the time during which the Max. Voltage trip condition must be maintained to prompt the activation of the grid Max. Voltage fault.	

P087 Max. Voltage Reset Time

P087	Range	20 ÷ 1000	0.020 ÷ 1.000 s
Max. Voltage Reset Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	687	
	Function	This is the time during which the Max. Voltage reset condition must be maintained to prompt the deactivation of the grid Max. Voltage fault.	

P088 Min. Voltage Trip Threshold

P088	Range	60 ÷ 900	60 ÷ 90 % of Vn
Min. Voltage Trip Threshold	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	688	
	Function	This parameter is expressed as a percentage of the rated grid voltage; it sets the trip threshold for the grid Min. Voltage fault.	

P089 Min. Voltage Release Ratio

P089	Range	1000 ÷ 1200	1.000 ÷ 1.200
Min. Voltage Release Ratio	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	689	
	Function	This parameter sets the ratio between the trip voltage value for the Min. Voltage fault and the value at which it is reset.	

P090 Min. Voltage Trip Time

P090	Range	20 ÷ 1000	0.020 ÷ 1.000 s
Min. Voltage Trip Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	690	
	Function	This is the time during which the Min. Voltage trip condition must be maintained to prompt the activation of the grid Min. Voltage fault.	

P091 Min. Voltage Reset Time

P091	Range	20 ÷ 1000	0.020 ÷ 1.000 s
Min. Voltage Reset Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	691	
	Function	This is the time during which the Min. Voltage reset condition must be maintained to prompt the deactivation of the grid Min. Voltage fault.	

P092 Inst. Undervoltage Threshold

P092	Range	50 ÷ 90	50 ÷ 90 % of Vn
Inst. Undervoltage Threshold	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	692	
	Function	This parameter is expressed as a percentage of the rated grid voltage; it sets the trip threshold for the grid Instantaneous Undervoltage fault.	

P093 Inst. Undervoltage Release Ratio

P093	Range	1000 ÷ 1100	1.0 ÷ 1.2
Inst. Undervoltage Release Ratio	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	693	
	Function	This parameter sets the ratio between the trip voltage value for the Instantaneous Undervoltage fault and the value at which it is reset.	

P094 Inst. Undervoltage Trip Time

P094	Range	1 ÷ 1000	0.001 ÷ 1.000 s
Inst. Undervoltage Trip Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	694	
	Function	This is the time during which the Instantaneous Undervoltage trip condition must be maintained to prompt the activation of the grid Instantaneous Undervoltage fault.	

P095 Inst. Undervoltage Reset Time

P095	Range	1 ÷ 1000	0.001 ÷ 1.000 s
Inst. Undervoltage Reset Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	695	
	Function	This is the time during which the Instantaneous Undervoltage reset condition must be maintained to prompt the deactivation of the grid Instantaneous Undervoltage fault.	

P096 Max. Frequency Trip Threshold

P096	Range	10 ÷ 200	0.1 ÷ 2.00 Hz
Max. Frequency Trip Threshold	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	696	
	Function	This parameter sets the max. frequency offset with respect to the rated value which determines the tripping of the grid Max. Frequency fault.	

P097 Max. Frequency Release Ratio

P097	Range	995 ÷ 1100	0.995 ÷ 1.0
Max. Frequency Release Ratio	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	697	
	Function	This parameter sets the ratio between the trip value of the Max. Frequency fault and the value at which it is reset.	

P098 Max. Frequency Trip Time

P098	Range	40 ÷ 1000	0.040 ÷ 1.000 s
Max. Frequency Trip Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	698	
	Function	This is the time during which the Max. Frequency trip condition must be maintained to prompt the activation of the grid Max. Frequency fault.	

P099 Max. Frequency Reset Time

P099	Range	40 ÷ 1000	0.040 ÷ 1.000 s
Max. Frequency Reset Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	699	
	Function	This is the time during which the Max. Frequency reset condition must be maintained to prompt the deactivation of the grid Max. Frequency fault.	

P100 Min. Frequency Trip Threshold

P100	Range	-200 ÷ -10	-2 ÷ -0.1 Hz
Min. Frequency Trip Threshold	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	700	
	Function	This parameter sets the max. frequency offset with respect to the rated value which determines the tripping of the grid Min. Frequency fault.	

P101 Min. Frequency Release Ratio

P101	Range	1000 ÷ 1006	1.000 ÷ 1.006
Min. Frequency Release Ratio	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	701	
	Function	This parameter sets the ratio between the frequency trip value for the Min. Frequency fault and the value at which it is reset.	

P102 Min. Frequency Trip Time

P102	Range	40 ÷ 1000	0.040 ÷ 1.000 s
Min. Frequency Trip Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	702	
	Function	This is the time during which the Min. Frequency trip condition must be maintained to prompt the activation of the grid Min. Frequency fault.	

P103 Min. Frequency Reset Time

P103	Range	40 ÷ 1000	0.040 ÷ 1.000 s
Min. Frequency Reset Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	703	
	Function	This is the time during which the Min. Frequency reset condition must be maintained to prompt the deactivation of the grid Min. Frequency fault.	

P104 Max. Frequency Derivative Trip Threshold

P104	Range	10 ÷ 100	0.10 ÷ 1.00 Hz/s
Max. Frequency Derivative Trip Threshold	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	704	
	Function	This parameter sets the max. frequency derivative for the grid Max. Frequency Derivative fault trip.	

P105 Max. Frequency Derivative Release Ratio

P105	Range	900 ÷ 1000	0.900 ÷ 1.000
Max. Frequency Derivative Release Ratio	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	705	
	Function	This parameter sets the ratio between the frequency trip value for the Max. Frequency Derivative fault and the value at which it is reset.	

P106 Max. Frequency Derivative Trip Time

P106	Range	40 ÷ 1000	0.040 ÷ 1.000 s
Max. Frequency Derivative Trip Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	706	
	Function	This is the time during which the Max. Frequency Derivative trip condition must be maintained to prompt the activation of the Max. Frequency Derivative fault.	

P107 Max. Frequency Derivative Reset Time

P107	Range	40 ÷ 1000	0.040 ÷ 1.000 s
Max. Frequency Derivative Reset Time	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	707	
	Function	This is the time during which the Max. Frequency Derivative reset condition must be maintained to prompt the deactivation of the Max. Frequency Derivative fault.	

P122 Average Overvoltage Threshold

P122	Range	110 ÷ 115	110 ÷ 115 %
Average Overvoltage Threshold	Default	See “Certification and Grid Interface File”	
	Level	See “Certification and Grid Interface File”	
	Address	722	
	Function	If the average value of the grid voltage exceeds the value set in this parameter, the inverter is disconnected from the grid.	

5.3.9. ISOLATION SENSORS MENU P120 ÷ P121

This submenu allows changing the isolation resistance of the positive and negative poles of the PV Field with respect to the ground. It also allows setting a delay for the isolation loss alarm.

Parameter	Function	Access Level	Modbus Address
P120	Min. Isolation Resistance	ADVANCED	720
P121	Isolation Sensor Alarm Trip Delay	ADVANCED	721

Table 66: List of the parameters in the Isolation Sensors menu P120 ÷ P121

P120 Min. Isolation Resistance

P120	Range	10 ÷ 1000	0.01 ÷ 1 MΩ
Min. Isolation Resistance	Default	1000	1 MΩ
	Level	ADVANCED	
	Address	720	
	Function	This parameter allows setting the isolation resistance threshold that causes the activation of the isolation loss alarm when the time set in P121 is over.	

P121 Isolation Sensor Alarm Trip Delay

P121	Range	0 ÷ 10000 ms	0 ÷ 10000 ms
Isolation Sensor Alarm Trip Delay	Default	5000	5000 ms
	Level	ADVANCED	
	Address	721	
	Function	Trip delay for the alarm activated when the isolation resistance between the field and the ground drops below the value set in P120.	

5.3.10. MULTIFUNCTION DIGITAL OUTPUT MENU P235 ÷ P238

This menu allows setting the MDO4 digital output available to the user.

It is possible to set the type of activity for this output and the activation/deactivation delays.

Parameter	Function	Access Level	Modbus Address
P235	MDO4 Output Logic Level	ADVANCED	835
P236	Enable Delay	ADVANCED	836
P237	Disable Delay	ADVANCED	837
P238	MDO4 Output Signal Selection	ADVANCED	838

Table 67: List of the parameters in the Digital Output menu P235 ÷ P238

P235 MDO4 Output Logic Level

P235	**Range**	0 ÷ 1	FALSE LOGIC ÷ TRUE LOGIC
MDO4 Output Logic Level	**Default**	1	TRUE LOGIC
	Level	ADVANCED	
	Address	835	
	Function	This parameter allows setting the type of logic for the MDO4 digital output: TRUE LOGIC: Activated output with active control variable; FALSE LOGIC: Activated output with inactive control variable.	

P236 MDO4 Digital Output Enable Delay

P236	**Range**	0 ÷ 60000	0.00 ÷ 600.00 s
Enable Delay	**Default**	0	0.00 s
	Level	ADVANCED	
	Address	836	
	Function	This parameter allows setting the activation delay for the MDO4 digital output.	

P237 MDO4 Digital Output Disable Delay

P237	**Range**	0 ÷ 60000	0.00 ÷ 600.00 s
Disable Delay	**Default**	0	0.00s
	Level	ADVANCED	
	Address	837	
	Function	This parameter allows setting the deactivation delay for the MDO4 digital output.	

P238 MDO4 Output Signal Selection

P238	**Range**	0 ÷ 6	0: DISABLED 1: N.A. 2: V FIELD KO 3: WARNING 4: GRID KO 5: INVERTER KO 6: WARNING or ALARM
MDO4 Output Signal Selection	**Default**	0	0: DISAB
	Level	ADVANCED	
	Address	838	
	Function	**0: DISABLED**, inactive output **1: N.A.**, not applicable **2: V FIELD KO**, signalling of isolation faults at the PV field **3: WARNING**, signalling of active warnings **4: GRID KO**, signalling of grid faults **5: INVERTER KO**, signalling of inverter locked (inverter in alarm status) **6: WARNING or ALARM**, signalling of active warning or alarm	

5.3.11. CLOCK/CALENDAR MENU

The clock/calendar in the control board is a copy of the clock/calendar in the Data Logger board, so this menu is available only if the inverter is provided with the Data Logger option.

At the moment, the clock/calendar function does not implement daylight saving time.

The clock/calendar can be set through dedicated parameters. Changes come immediately to effect if the display/keypad is used to set up the clock/calendar: select the Set Time page or the Set Date page and press ENTER. On the contrary, if the changes are made using the serial link of the inverter where the board is installed, the clock/calendar is displayed under the measure parameters described below. To set the clock/calendar through the serial link, use the editing command (P398) after entering the new setting of the clock/calendar with parameters P391 to P398.

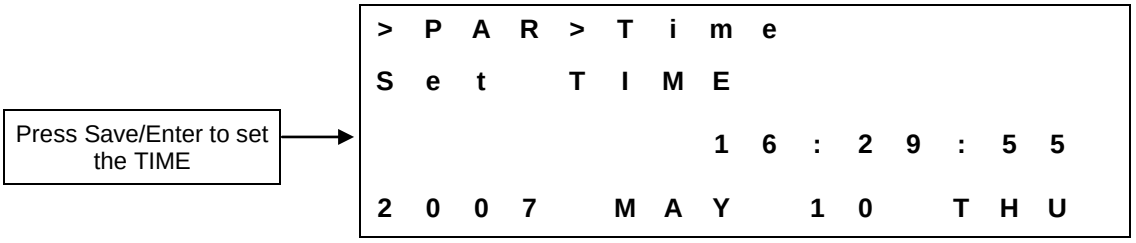


Table 68: First page in the Date & Time menu appearing on the display/keypad

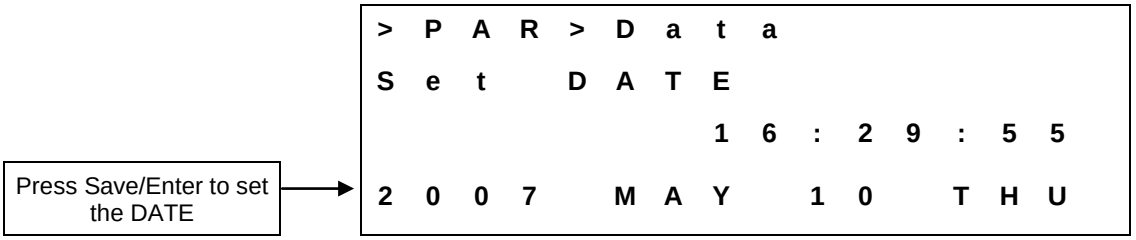


Table 69: Second page in the Date & Time menu appearing on the display/keypad

Time

Time	Range	0 ÷ 23	0 ÷ 23 hours
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	3300	
	Level	BASIC	
	Function	Time - hours (current value).	

Minutes

Minutes	**Range**	0 ÷ 59	0 ÷ 59 min
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	3301	
	Level	BASIC	
	Function	Minutes (current value).	

Seconds

Seconds	**Range**	0 ÷ 59	0 ÷ 59 sec
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	3302	
	Level	BASIC	
	Function	Seconds (current value).	

Day of the Week

Day of the Week	**Range**	1 ÷ 7	1: Mon. 2: Tues. 3: Wed. 4: Th. 5: Fri. 6: Sat. 7: Sun.
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	3303	
	Level	BASIC	
	Function	Day of the week (current value).	

Day of the Month

Day of the Month	**Range**	1 ÷ 31	1 ÷ 31 days
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	3304	
	Level	BASIC	
	Function	Day of the month (current value).	

Month

Month	**Range**	1 ÷ 12	1: January 2. February 3: March 4: April 5: May 6: June 7: July 8: August 9: September 10: October 11: November 12: December
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	3305	
	Level	BASIC	
	Function	Month (current value)	

Year

Year	**Range**	2000 ÷ 2099	2000 ÷ 2099 years
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	3306	
	Level	BASIC	
	Function	Year (current value)	

Parameter	Function	Access Level	Modbus Address
P391	Day of the Week to be modified	ADVANCED	991
P392	Day of the Month to be modified	ADVANCED	992
P393	Month to be modified	ADVANCED	993
P394	Year to be modified	ADVANCED	994
P395	Time (Hour) to be modified	ADVANCED	995
P396	Time (Minutes) to be modified	ADVANCED	996
P398	Clock/Calendar Editing Command	ADVANCED	998

Table 70: List of the parameters P391 ÷ P398

P391 Day of the Week to be modified

P391	**Range**	1 ÷ 7	1: Mon. 2: Tues. 3: Wed. 4: Th. 5: Fri. 6: Sat. 7: Sun.
Day of the Week to be modified	**Default**	1	1: Mon.
	Level	ADVANCED	
	Active	This parameter can be modified only if the Data Logger board is installed and activated.	
	Address	991	
	Function	This parameter contains the value of the day of the week to be modified.	

P392 Day of the Month to be modified

P392	**Range**	1 ÷ 31	1 ÷ 31 days
Day of the Month to be modified	**Default**	1	Day 1
	Level	ADVANCED	
	Active	This parameter can be modified only if the Data Logger board is installed and activated.	
	Address	992	
	Function	This parameter contains the value of the day of the month to be modified.	

P393 Month to be modified

P393	**Range**	1 ÷ 12	1: January 2. February 3: March 4: April 5: May 6: June 7: July 8: August 9: September 10: October 11: November 12: December
Month to be modified	**Default**	1	1: January
	Level	ADVANCED	
	Active	This parameter can be modified only if the Data Logger board is installed and activated.	
	Address	993	
	Function	This parameter contains the value of the month to be modified.	

P394 Year to be modified

P394	**Range**	2000 ÷ 2099	2000 ÷ 2099 years
Year to be modified	**Default**	0	Year 2000
	Level	ADVANCED	
	Active	This parameter can be modified only if the Data Logger board is installed and activated.	
	Address	994	
	Function	This parameter contains the value of the year to be modified.	

P395 Time (hours) to be modified

P395	Range	0 ÷ 23	0 ÷ 23 hours
Time (hours) to be modified	Default	0	0 hours
	Level	ADVANCED	
	Active	This parameter can be modified only if the Data Logger board is installed and activated.	
	Address	995	
	Function	This parameter contains the value of the time (hours) to be modified	

P396 Time (minutes) to be modified

P396	Range	0 ÷ 59	0 ÷ 59 min.
Time (minutes) to be modified	Default	0	0 minutes
	Level	ADVANCED	
	Active	This parameter can be modified only if the Data Logger board is installed and activated.	
	Address	996	
	Function	This parameter contains the value of the time (minutes) to be modified	

P398 Clock/Calendar Editing Command

P398	Range	0 ÷ 1	0 ÷ 1
Clock/Calendar Editing Command	Default	0	0
	Level	ADVANCED	
	Active	This parameter can be modified only if the Data Logger board is installed and activated.	
	Address	998	
	Function	If this parameter is set to 1, all values set in parameters P2010 ÷ P2012 are written and stored to the clock/calendar of the board, thus changing immediately the values described above. CAUTION This command prompts the implementation of all the clock parameters, even the unchanged ones. Therefore, make sure that also the unchanged parameters are correct.	

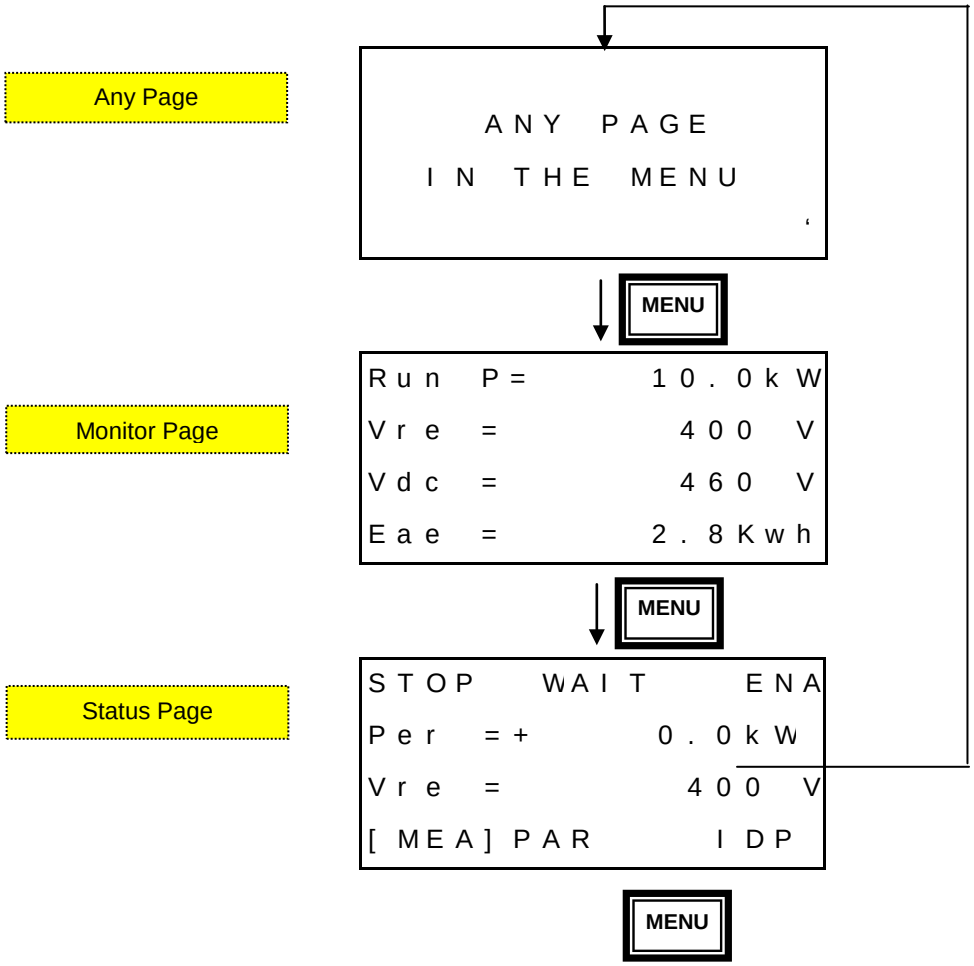
5.3.12. KEYPAD PAGES MENU

This menu includes the parameters allowing to set the navigation modes and display modes for the user interface (display/keypad module).

By pressing the **MENU** key on the display/keypad module it is possible to navigate directly to the following preset pages:

- Monitor Page
- Status Page

By pressing the **MENU** key again, the starting page of the navigation is displayed.



NOTE [**]

The Monitor page can be customised through the PAR menu in the KEYPAD PAGES page.

Status Page

S T O P	W A I T	E N A
® P e r	= + 0 . 0 k W	
® V r e	= 2 2 0 V	
M E A	P A R C F [I D P]	

Line 1 on this page shows the operating status of the inverter (see the description of measure M089).

Line 2 and 3 contain two measures that can be selected through parameters P268, P268a.

Line 4 displays the four main menus of the inverter. The menu currently selected is the one between square brackets: use the ▲ and ▼ keys to change the selection and press the **SAVE/ENTER** key to access the selected menu.

NOTE

The four main menus can be accessed from this page only. The main menus are the following:

MEA *® Measures*

PAR *® Programming Parameters*

CF *® Configuration Parameters (accessible only with the ADVANCED level)*

IDP *® Product ID*

Monitor Page

P m n	=	2 . 0 k W
V m n	=	2 2 0 V
V f i e l d	=	3 5 0 V
E a e	=	2 . 8 k w h

Under the factory settings, the Monitor page is the first page displayed when the inverter is powered on.

Monitor Help

® M 0 0 8
® M 0 0 4
® M 0 0 6
® M 0 0 0

Line 1 in the Monitor page shows the inverter status and the power delivered. The Monitor page also allows displaying three measures that can be set via parameters **P268b ÷ P268d**. On the Monitor page, by pressing the **SAVE/ENTER** key the Help page is displayed for a few seconds, with a description of the measures shown in the Monitor page.

Parameter	Function	Access Level	Modbus Address
P268	Measure n.1 on Status Page	ADVANCED	Not accessible
P268a	Measure n.2 on Status Page	ADVANCED	Not accessible
P268b	Measure n.2 on Monitor Page	ADVANCED	Not accessible
P268c	Measure n.3 on Monitor Page	ADVANCED	Not accessible
P268d	Measure n.4 on Monitor Page	ADVANCED	Not accessible

Table 71: List of the programmable parameters P268 ÷ P268d

P268 (P268a) Measure n.1 (n.2) on the Status Page

P268 / P268a	**Range**	**U000, U0004, M000 ÷ M089** (See complete list under MEASURES MENU).
Measure n.1 (n.2) on the Status Page	**Default**	**P268** ® **M008** (Power delivered) **P268a** ® **M000** (Field voltage)
	Level	ADVANCED
	Address	Not accessible via serial link.
	Function	These parameters allow selecting the two measures, among the available inverter measures, that are displayed on the Status page.

P268b (P268c, P268d) Measure n.2 (n.3, n.4) on the Monitor Page

P268b,c,d,e	**Range**	**U000, U0004, M000 ÷ M089** (See complete list under MEASURES MENU).
Measure n.2 (n.3, n.4) on the Monitor Page	**Default**	**P268c** ® **M004** (Grid voltage) **P268b** ® **M000** (PV field voltage) **P268c** ® **M010** (Active energy delivered)
	Level	ADVANCED
	Address	Not accessible via serial link.
	Function	These parameters allow selecting the three measures displayed on the Monitor page.

5.3.13. ENERGY COUNTERS MENU P130 ÷ P135

This menu allows accessing the parameters and measures related to the Energy Counters.

Parameter	Function	Access Level	Modbus Address
P130	Energy Count Value per KWh	ADVANCED	676
P131	External Energy Counter Function	ADVANCED	731
P132	Energy Counter Gain	ADVANCED	732
P134	No. of pulses per KWh	ADVANCED	734
P135L	Preset x0.01 Energy Counter	ADVANCED	735
P135H	Preset x100 Energy Counter	ADVANCED	736

Table 72: List of the parameters and measures P130 ÷ P135

NOTE

When using the energy counter preset function (parameters P135L - P135H), the value set in the programming parameters is transferred to the relevant energy counter only if the parameter setting is updated.

For example – if P135L=0 and P135H=123 at power on – when you save P135L=0 (i.e. the same starting value) no preset function is implemented. In this case, to implement the preset function the user should enter any value other than zero for P135L, or any value other than 123 for P135H.

P130 Energy Count Value per KWh

P130			
Energy Count Value per KWh	**Range**	0 ÷ 10000	0.0 ÷ 10.000 euros
	Default	445	0.445 euros
	Level	ADVANCED	
	Address	676	
	Function	This parameter represents the refund per KWh of the Energy Count.	

P131 External Energy Counter Function

P131	**Range**	0 ÷ 2	0: DISABLED 1: COUNTER FOR ENERGY DELIVERED 2: DIFFERENTIAL ENERGY DELIVERED
External Energy Counter Function	**Default**	0	0: DISABLED
	Level	ADVANCED	
	Address	731	
	Function	This parameter controls the external energy counter function. Function 1 allows counting (with 0.5KWh steps) and displaying the energy counted by an external pulse counter. Function 2 allows forward counting (with 0.5KWh steps) for the energy delivered and backward counting (with 0.5KWh steps) for the energy absorbed.	

P132 Energy Counter Gain

P132	**Range**	750 ÷ 1500	0.75 ÷ 1.5
Energy Counter Gain	**Default**	1000	1
	Level	ADVANCED	
	Address	732	
	Function	This parameter allows rectifying the gain for the active energy counter M010.	

P134 No. of pulses per KWh

P134	**Range**	1 ÷ 10000	1 ÷ 10000 pulses per kWh
Pulses per KWh	**Default**	100	100 pulses per kWh
	Level	ADVANCED	
	Address	734	
	Function	This parameter allows setting the number of pulses from an external energy counter corresponding to a kWh of energy (delivered energy or absorbed energy).	

P135L Preset x0.01 Energy Counter

P135L			
Preset x0.01 Energy Counter	Range	0 ÷ 9999	00.00 ÷ 99.99 kWh
	Default	0	0
	Level	ADVANCED	
	Address	735	
	Function	This parameter allows presetting the value stored in the energy counter, with a resolution of 0.01 KWh. Important: when presetting is performed, the partial counter for the active energy delivered to the grid (M011) is reset.	

P135H Preset x100 Energy Counter

P135H			
Preset x100 Energy Counter	Range	0 ÷ 10000	100 ÷ 1000000 kWh
	Default	0	0
	Level	ADVANCED	
	Address	736	
	Function	This parameter allows presetting the value stored in the energy counter, with a resolution of 100 KWh. Important: when presetting is performed, the partial counter for the active energy delivered to the grid (M011) is reset.	

5.3.14. DATA LOGGER MENU

This menu can be viewed only if the inverter is provided with the Data Logger board (option), that allows logging weather variables and operating variables of the PV plant and interfacing it with a Supervisor PC (or a remote computer), through different connection modes to implement data logging and monitoring functions for all the devices integrated in the plant.

The Data Logger menu allows accessing a series of programming parameters – both via the display/keypad module and via the inverter serial link – and measures relating to the status of the Data Logger board. Since the programming procedures affect a subgroup of parameters of the board, it is recommended to refer to the Data Logger Programming Instructions manual for further details.

CAUTION

The programming of the above-mentioned parameters only prompts a runtime overwriting of the current values, but the new values are not stored to the non-volatile memory of the Data Logger board. Therefore, it is recommended to confirm the new parameter settings by accessing directly the Data Logger board (e.g. via the Remote Sunway).

This menu includes 5 sub-menus, as shown in the figure below.

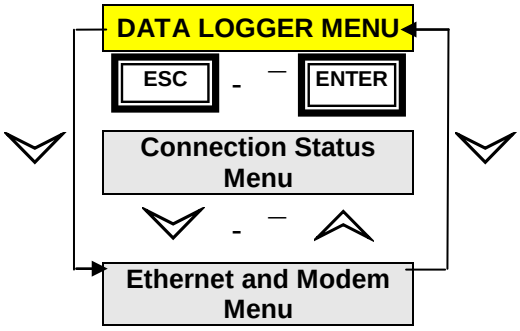


Figure 73: Structure of the Data Logger menu

5.3.14.1. Connections Status Menu

The page containing the menu name displays two measures indicating the status of the board and the alarms tripped (if any).

Parameter	Function	Access Level	Modbus Address
	Data Logger Board Status	BASIC	1336
	Data Logger Error Status	BASIC	1340
	Connections Status	BASIC	1338
	Preset Connections Status	BASIC	1337
	Preset Connections	BASIC	134

Table 73: List of the measures in the Connections Status menu

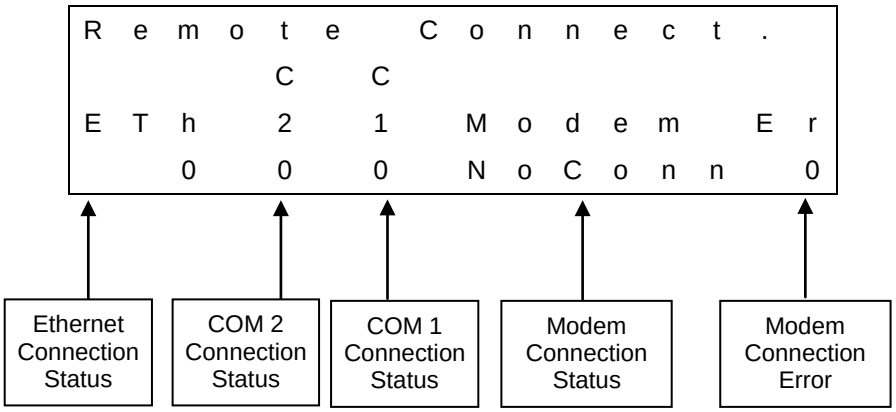
Data Logger Board Status

Data Logger Board Status	**Range**	0 ÷ 2	0: NOT FITTED 1: OK NOT INTERL 2: OK INTERLOCKED
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	1336	
	Level	BASIC	
	Function	**0: NOT FITTED**, the Data Logger board is not installed on the inverter (in this case, the Data Logger menu cannot be viewed too). **1: OK NOT INTERL**, the Data Logger board is operating independently of the inverter on which it is installed. Therefore, the Data Logger menu and Connections Status menu can be viewed, but the other sub-menus are not accessible. To program the board it is necessary to connect directly to it through the Remote Sunway (computer) by setting, if needed, a proper preset value in the Connections Status menu (see **Preset Connection Status**). **2: OK INTERLOCKED**, the Data Logger board can be programmed even via the display/keypad module of the inverter on which it is installed.	

Data Logger Error Status

Data Logger Error Status	**Range**	0 ÷ 6 - 99 ÷ 105	0: No alarm. 1: Parameter save fault. 2: Log write error. 3: FBS configuration failure. 4: RS232 Modbus configuration failure. 5: RS485 Modbus configuration failure. 6: TCP/IP stack configuration failure. 99: Flash card missing or not accessible. 100: Invalid access to stream. 101: TCP/IP socket fault. 102: Dial out connection failure. 103: Clock 821 fault. 104: Modem initialization failure. 105: Modem not fitted or not powered on.
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	1340	
	Level	BASIC	
	Function	The active measure indicates the current general alarm tripped on the board. In case an alarm activates, please contact Elettronica Santerno AFTER-SALE SERVICE, stating the alarm code and name.	

By pressing the Save/Enter key on the display/keypad module it is possible to access the first page of the submenu showing the status of the connections supported by the Data Logger board (Serial links, Ethernet and modem).


R e m o t e C o n n e c t .
C C
E T h 2 1 M o d e m E r
0 0 0 N o C o n n 0
Ethernet Connection Status
COM 2 Connection Status
COM 1 Connection Status
Modem Connection Status
Modem Connection Error

Remote Connections Status

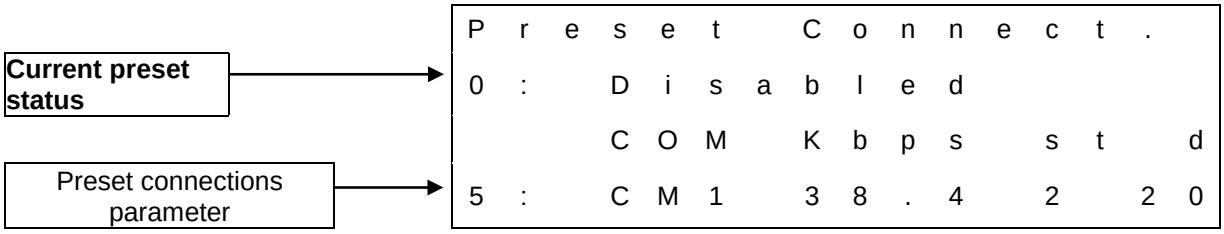
Remote Connections Status	**Range**	Bit-controlled measure	See Table 74
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	1338	
	Level	BASIC	
	Function	It indicates the status of the connections supported by the Data Logger board. Note that the COM1 serial link is RS232 by default, whereas COM2 is RS485 by default. For more details on the meanings of each layer, please refer to the Programming Instructions manual for the Data Logger board.	

Bit no.	Connection	
0-7	Type of error of the modem connection	0: None 1: Dial ko 2: Connect ko 3: Authentication ko 4: IPCP ko 5: Modem not yet initialized 6: Modem init ko 7: Modem not configured 8: Modem not dial out 16: Connect end (echo time out) 32: Connect end (idle time out) 64: Connect end (term expired)

Bit no.	Connection	
8-10	Status of the connection via modem	0: No connection 1: Dialling 2: Connecting 4: Connected 5: Attempt finished
11	Com 1	0: No data exchange 1: Data exchanged
12	Com 2	0: No data exchange 1: Data exchanged
13-15	Ethernet	0: No connection 1: Connection

Table 74: Bit-map of the connections status

From the second page of the submenu, it is possible to force preset configurations to the board through the Preset Connections parameter. The measure of the current state of the preset connection is shown in line 2 of the page.



CAUTION

The preset connections are implemented only after resetting the Data Logger board.

Preset Connection Status

Preset Connection Status	**Range**	0 ÷ 20	0: No active presetting 1: Ethernet enabled 2: PPP null modem 3: COM 1 Modbus Slave- 38400bps- 2STOP bit- no parity- timeout=2 ms 4: COM 1 Modbus Slave- 38400bps- 1STOP bit- no parity- timeout=2 ms 5:COM 1 Modbus Slave- 38400bps- 2STOP bit- no parity- timeout=20 ms 6:COM 1 Modbus Slave- 38400bps- 1STOP bit- no parity- timeout=20 ms 7: COM 1 Modbus Slave- 9600bps- 2STOP bit- no parity- timeout=2 ms 8: COM 1 Modbus Slave- 9600bps- 1STOP bit- no parity- timeout=2 ms 9: COM 1 Modbus Slave- 9600bps- 2STOP bit- no parity- timeout=20 ms 10:COM 1 Modbus Slave- 9600bps- 1STOP bit- no parity- timeout=20 ms 11: COM 2 Modbus Slave- 38400bps- 2STOP bit- no parity- timeout=2 ms 12: COM 2 Modbus Slave- 38400bps- 1STOP bit- no parity- timeout=2 ms 13:COM 2 Modbus Slave- 38400bps- 2STOP bit- no parity- timeout=20 ms 14:COM 2 Modbus Slave- 38400bps- 1STOP bit- no parity- timeout=20 ms 15: COM 2 Modbus Slave- 9600bps- 2STOP bit- no parity- timeout=2 ms 16: COM 2 Modbus Slave- 9600bps- 1STOP bit- no parity- timeout=2 ms 17: COM 2 Modbus Slave- 9600bps- 2STOP bit- no parity- timeout=20 ms 18: COM 2 Modbus Slave- 9600bps- 1STOP bit- no parity- timeout=20 ms 19: Analogue Modem 20: Digital Modem
	Active	This measure is available only if the Data Logger board is installed and activated.	
	Address	1337	
	Level	ADVANCED	
	Function	It indicates if preset configurations are forced to board.	

Preset Connection Status

Preset Connection Status	**Range**	0 ÷ 20	0: No active presetting 1: Ethernet enabled 2: PPP null modem 3: COM 1 Modbus Slave- 38400bps- 2STOP bit- no parity- timeout=2 ms 4: COM 1 Modbus Slave- 38400bps- 1STOP bit- no parity- timeout=2 ms 5: COM 1 Modbus Slave- 38400bps- 2STOP bit- no parity- timeout=20 ms 6: COM 1 Modbus Slave- 38400bps- 1STOP bit- no parity- timeout=20 ms 7: COM 1 Modbus Slave- 9600bps- 2STOP bit- no parity- timeout=2 ms 8: COM 1 Modbus Slave- 9600bps- 1STOP bit- no parity- timeout=2 ms 9: COM 1 Modbus Slave- 9600bps- 2STOP bit- no parity- timeout=20 ms 10: COM 1 Modbus Slave- 9600bps- 1STOP bit- no parity- timeout=20 ms 11: COM 2 Modbus Slave- 38400bps- 2STOP bit- no parity- timeout=2 ms 12: COM 2 Modbus Slave- 38400bps- 1STOP bit- no parity- timeout=2 ms 13:COM 2 Modbus Slave- 38400bps- 2STOP bit- no parity- timeout=20 ms 14:COM 2 Modbus Slave- 38400bps- 1STOP bit- no parity- timeout=20 ms 15: COM 2 Modbus Slave- 9600bps- 2STOP bit- no parity- timeout=2 ms 16: COM 2 Modbus Slave- 9600bps- 1STOP bit- no parity- timeout=2 ms 17: COM 2 Modbus Slave- 9600bps- 2STOP bit- no parity- timeout=20 ms 18: COM 2 Modbus Slave- 9600bps- 1STOP bit- no parity- timeout=20 ms 19: Analogue Modem 20: Digital Modem
	Default	0	0: no active presetting
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	134	
	Function	This parameter allows forcing one of the connection modes listed above to the Data Logger board. The connection modes relying on the Ethernet and modems take on the parameters they need from the ones currently stored in the inverter (see following sections). Configurations 19 and 20 support both dial in and dial out functions from the board.	

NOTE

*The Data Logger board is forced into the Interlocked operating mode once a presetting mode from those listed above has been implemented (see **Data Logger Board Status**).*

When the programming is made via the display/keypad module, you only need to set the desired preset number. When the serial link is used for programming, it is also necessary to write and save the F123 hex code to the Modbus address 133.

5.3.14.2. Ethernet and Modem Menu R100 ÷ R115

This submenu includes the parameters used for the configuration of the Ethernet/modem connections. These parameters activate only after resetting the board.

CAUTION

Starting from software version DL166X of the Data Logger board, the Ethernet connection is factory-set to Internet connection, so it CANNOT be modified via the display/keypad module of the inverter. The type of connection desired (e.g. LAN or GSM/GPRS modem) must then be specified when ordering the equipment. Otherwise, programming must be carried out directly on the Data Logger board (please refer to the Programming Instructions manual of the Data Logger board).

Parameter	Function	Access Level	Modbus Address
R100	IP address high	ADVANCED	1332
R101	IP address low	ADVANCED	1333
R102	IP mask high	ADVANCED	1334
R103	IP mask low	ADVANCED	1335
R104+R105+ R106	SMS 1 Phone Number	ADVANCED	569, 570, 571
R108+R109+ R110	SMS 2 Phone Number	ADVANCED	572, 573, 574
R111	PPP IN Username	ADVANCED	575
R112	PPP IN Password	ADVANCED	576
R113	PPP OUT Username	ADVANCED	577
R114	PPP OUT Password	ADVANCED	578
R115	SIM card PIN	ADVANCED	563

Table 75: List of the parameters in the Ethernet and Modem menu R100 ÷ R115

R100 IP Address High

R100	Range	0 ÷ 0xFFFF	0.0 ÷ 255.255
IP Address High	Default	0xC0A8	192.168
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	1332	
	Function	This parameter sets the two high bytes of the static IP address of the board.	

R101 IP Address Low

R101	Range	0 ÷ 0xFFFF	0.1 ÷ 255.254
IP Address Low	Default	0x2	0.2
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	1333	
	Function	This parameter sets the two low bytes of the static IP address of the board.	

CAUTION

Addresses X.X.X.0 and X.X.X.255 are not available, since they are reserved for the network protocol. The IP addresses that can be assigned to the board range from 1 to 254.

R102 IP Mask High

R102	Range	0 ÷ 0xFFFF	0.0 ÷ 255.255
IP Mask High	Default	0xFFFF	255.255
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	1334	
	Function	This parameter sets the two high bytes of the IP mask of the board.	

R103 IP Mask Low

R103	Range	0 ÷ 0xFFFF	0.0 ÷ 255.255
IP Mask Low	Default	0xFF00	255.0
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	1335	
	Function	This parameter sets the two low bytes of the IP mask of the board.	

R104+R105+R106 SMS 1 Phone Number

R104+R105+R106	Range	0x0 ÷ 0xFFFFFFFFFFFF	“000000000000” ÷ “FFFFFFFFFFFF”
SMS Phone Number	Default	0x390000000000	“390000000000”
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	569 - 570 - 571	
	Function	This parameter is composed of three words and contains the mobile phone number receiving the SMS sent by the Data Logger board. The mobile phone number is represented as hexadecimal digits; it is to be aligned left and any digit higher than 9 is intended as the number terminator. The first two digits are dedicated to the international code. Italy’s international code is set as the default code.	

CAUTION

The Data Logger can send SMSs only if its communication system is a GSM or Internet one.

R108+R109+R110 SMS 2 Phone Number

R108+R109+R110			
SMS Phone Number	Range	0x0 ÷ 0xFFFFFFFFFFFF	“000000000000” ÷ “FFFFFFFFFFFF”
	Default	0x390000000000	“390000000000”
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	572 - 573 - 574	
	Function	This parameter is composed of three words and contains the mobile phone number receiving the SMS sent by the Data Logger board. The mobile phone number is represented as hexadecimal digits; it is to be aligned left and any digit higher than 9 is intended as the number terminator. The first two digits are dedicated to the international code. Italy’s international code is set as the default code.	

R111 (R113) PPP Username

R111 (PPP IN) R113 (PPP OUT)			
PPP Username	Range	0 ÷ 0xFFFF	“0000” ÷ “FFFF”
	Default	0x1111	“1111”
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	575 – 577	
	Function	This parameter sets the username for a point-to-point connection to the Data Logger board from a remote computer (PPP IN) and for the connection from the Data Logger board to a remote computer (PPP OUT). Any digit higher than 9 is intended as the number terminator.	

R112 (R114) PPP Password

R112 (PPP IN) R114 (PPP OUT)			
PPP Password	Range	0 ÷ 0xFFFF	“0000” ÷ “FFFF”
	Default	0x1234	“1234”
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	576 – 578	
	Function	This parameter sets the password for a point-to-point connection to the Data Logger board from a remote computer (PPP IN) and for the connection from the Data Logger board to a remote computer (PPP OUT). Any digit higher than 9 is intended as the number terminator.	

R115 SIM card PIN

R115	Range	0x0 ÷ 0xFFFF	“0000” ÷ “FFFF”
SIM card PIN	Default	0x0	“0000”
	Level	ADVANCED	
	Active	This parameter is available and editable only if the Data Logger board is installed and activated.	
	Address	563	
	Function	This parameter sets the four digits of the PIN for the SIM card fitted in the GSM/GPRS modem. PIN is obtained from the hexadecimal representation of the number (filling with zeroes on the left until reaching 4 digits).	

5.4. CONFIGURATION [CF] MENU

The Configuration section includes the parameters that can be edited only when the inverter is in STOP mode.

5.4.1. Description

The Configuration menu allows managing a set of configuration parameters to which the user is allowed to access. The parameters are organized in the following subgroups:

Manager Menu

This menu includes the parameters related to the configuration of the plant where the inverter is installed, as well as the parameters relating to the Additional PV Field (PV2), the Ambient Measure Expansion Board and the Data Logger board.

Alarm Autoreset Menu

This menu includes the parameters related to the Autoreset function for the automatic reset of the equipment in case of alarms. The Autoreset menu also includes the parameters related to the management of the PV field isolation sensor integrated into the inverter.

EEPROM Menu

This menu contains the parameters that allow accessing the non-volatile memory sectors of the inverter where factory settings are stored and where it is possible to back-up the parameters modified by the user.

Serial Links Menu

This menu contains the parameters related to the inverter serial links.

5.4.2. MANAGER MENU C000 ÷ C008, R020 ÷ R021

This menu includes the parameters related to the configuration of the plant where the inverter is installed.

- Rated grid voltage and frequency setting.
- Grid interface protection relay setting.
- Management of the following options: Additional PV Field, auxiliary power supply, ambient measures expansion board.

The factory setting relates to standard installation:

- Grid voltage: 230 VAC / 50 Hz.
- Use of a grid interface protection relay integrated into the inverter.

If a different configuration is needed for the plant, parameters C000, C001, C004 and C006 should be set accordingly.

Parameters C003 and C005 are used to set an additional start delay if the plant often fails the starting procedure.

Parameters C007, R020 and R021 allow setting the options Additional PV Field (PV2) and Data Logger board, whereas parameter C010 allows setting the powering on/off of the inverter via serial link or from a remote computer.

Parameter	Function	Access Level	Modbus Address
C000	Rated Grid Voltage	ADVANCED	1000
C001	Rated Grid Frequency	ADVANCED	1001
C002	Number of Start Attempts	ADVANCED	1002
C003	Waiting Time in Stand-by (C002 Failed Starts)	ADVANCED	1003
C004	Waiting Time after External Relay Trip	ADVANCED	1004
C005	Time for Start OK	ADVANCED	1005
C006	Configuration of the Interface Protection Device	ADVANCED	1006
C007	PV Fields Configuration Mode	ADVANCED	1007
C008	Remote Control	ADVANCED	1008
R020	Data Logger Option	ADVANCED	219
R021	Ambient Sensors and Field I/Os Expansion Board Option	ADVANCED	294

Table 76: List of the parameters in the Manager menu C000 ÷ C008, R020 ÷ R021

C000 Rated Grid Voltage

C000	Range	1000 ÷ 6900	100.0 ÷ 690.0 V
Rated Grid Voltage	Default	2300	230.0 V
	Level	ADVANCED	
	Address	1000	
	Function	This parameter sets the rated grid voltage.	

C001 Rated Grid Frequency

C001	Range	400 ÷ 700	40.0 ÷ 70.0 Hz
Rated Grid Frequency	Default	See “Certification and Grid Interface File”.	
	Level	ADVANCED	
	Address	1001	
	Function	This parameter sets the rated grid frequency.	

C002 Number of Start Attempts

C002	Range	0 ÷ 32000	0 ÷ 32000
Number of Start Attempts	Default	10	10
	Level	ADVANCED	
	Address	1002	
	Function	Max. number of failed start attempts due to weak solar radiation or grid instability. When the max. number of failed attempts is reached, the equipment is put to stand-by (the stand-by timer is set in parameter C003).	

C003 Waiting Time in Stand-by

C003	Range	0 ÷ 60000	0 ÷ 6000.0 s
Waiting Time in S-BY	Default	18000	1800.0 s
	Level	ADVANCED	
	Address	1003	
	Function	This parameter sets the duration of the stand-by time if the number of failed starts reaches the same as the value set in C002.	

C004 Waiting Time after External Relay Trip

C004	Range	0 ÷ 60000	0 ÷ 6000.0 s
Waiting Time after External Relay Trip	Default	3000	300.0 s
	Level	ADVANCED	
	Address	1004	
	Function	This parameter sets the duration of the stand-by time in case of tripping of the external grid interface safety relay (fitted as an option).	

C005 Time for Start OK

C005	Range	0 ÷ 60000	0 ÷ 6000.0 s
Time for Start OK	Default	3000	300.0 s
	Level	ADVANCED	
	Address	1005	
	Function	The time set by this parameter is the time allowed for the successful start of the equipment and for the reset of the start attempt counter.	

C006 Configuration of the Interface Protection Device

C006	Range	0 ÷ 1	0: Standard 1: External IP
Configuration of the Interface Protection Device	Default	0	0
	Level	ADVANCED	
	Address	1006	
	Function	**0: Standard** – Single or multi-inverter configuration plant with an external interface protection device operating independently for each SUNWAY M PLUS (see wiring diagram for multi-inverter n≤3 and power rating ranging from 6 to 20kW). **1: External IP** – Multi-inverter configuration plant with an external interface protection (IP) device (see wiring diagram for multi-inverter n>3 or power rating exceeding 20kW).	

C007 PV Field Configuration Mode

C007	**Range**	0 ÷ 2	0: not present 1: present with PV1 2: only PV2
PV Field Configuration Mode	**Default**	0	0
	Level	ADVANCED	
	Active	This parameter can be viewed and changed only if the inverter is equipped with the Additional PV Field option (PV2).	
	Address	1007	
	Function	This parameter sets the configuration of the Additional PV Field (PV2).	

C008 Remote Control

C008	**Range**	0 ÷ 1	0: Disable 1: Enable
Remote Control	**Default**	0	0: Disable
	Level	ADVANCED	
	Address	1008	
	Function	This parameter allows managing the remote control function. The remote control allows starting and stopping the inverter from a remote PC, and also modifying the enable status of the automatic MPPT and its reference value.	

R020 Data Logger Option

R020	**Range**	0 ÷ 2	0: ES851 not present 1: Any bus boards 2: ES851 present
Data Logger Option	**Default**	0	0: ES851 not present
	Level	ADVANCED	
	Address	219	
	Function	This parameter sets the presence of the Data Logger board. **NOTE:** R020 is not affected by the Restore Default function (see I012).	

R021 Ambient Sensors and Field I/Os Expansion Board Option

R021	**Range**	0 ÷ 1	0: ES847 not present 1: ES847 present
Ambient Measure Expansion Board	**Default**	0	0: ES847 not present
	Level	ADVANCED	
	Address	301	
	Function	This parameter sets the presence of the Ambient Sensors and Field I/Os Expansion Board. **NOTE:** R021 is not affected by the Restore Default function (see I012).	

5.4.3. ALARM AUTORESET MENU C033 ÷ C046

The inverter is provided with an autoreset function, for the automatic reset of alarms. This function allows setting the maximum number of allowable autoreset attempts and the time required for the attempt counter to reset.

The autoreset function is enabled by entering a number of attempts other than zero in parameter C033. If the number of reset attempts occurred within time t < C034 is the same as the value set in C033, the autoreset function will be disabled. The autoreset function is re-enabled only when a time longer than or equal to the time set in C034 has elapsed from the last alarm tripped.

If the inverter is turned off when an alarm is active, the alarm tripped is stored to memory and the relevant alarm message will be displayed again when the inverter is next powered on. Regardless of the setting of the autoreset function, by setting parameter C035 to [Yes] it is possible to automatically reset the last alarm tripped (if any) at next power on.

Parameters C036 ÷ C042 and C045 allow disabling the autoreset function for certain parameters.

Parameter C043 allows setting the cooling time of the equipment before it is restarted after a thermal protection has tripped (such as in case of heatsink overheating, thermoswitch tripped, etc.).

This Alarm Autoreset menu also includes the parameter relating to the control of the PV field isolation sensor integrated into the inverter (C044).

For the list and description of the alarms, refer to section List of the Alarms A001 ÷ A135.

Parameter	Function	Access Level	Modbus Address
C033	Autoreset Attempts	ADVANCED	1033
C034	Reset Time for Autoreset Attempts	ADVANCED	1034
C035	Autoreset at Power On	ADVANCED	1035
C036	Thermal Protection Autoreset Enable	ADVANCED	1036
C037	Heatsink Overheating Autoreset Enable	ADVANCED	1037
C038	IGBT Fault Autoreset Enable	ADVANCED	1038
C039	Overcurrent Autoreset Enable	ADVANCED	1039
C040	Overvoltage Autoreset Enable	ADVANCED	1040
C041	Serial Link Fault Autoreset Enable	ADVANCED	1041
C042	Ambient Overtemperature Autoreset Enable	ADVANCED	1042
C043	Cooling Time	ADVANCED	1043
C044	PV Isolation Fault Control	ADVANCED	1044
C045	Isolation Fault Autoreset Enable	ADVANCED	1045
C046	On-Alarm Buzzer Enable	ADVANCED	1046

Table 77: List of the parameters in the Alarm Autoreset menu C033 ÷ C046

C033 Autoreset Attempts

C033	Range	0 ÷ 10	0=Disable ÷ 10
Autoreset Attempts	Default	4	4
	Level	ADVANCED	
	Address	1033	
	Function	If a value other than Disable (Disable = 0) is set, this parameter enables the autoreset function and sets the maximum allowable number of autoreset attempts that can occur within a time period set in C034. From the last alarm tripped, the autoreset attempt counter is reset if a time equal to the time set in C034 has elapsed.	

C034 Reset Time for Autoreset Attempts

C034	Range	1 ÷ 1000	1 ÷ 1000 s
Reset Time for Autoreset Attempts	Default	300	300 sec
	Level	ADVANCED	
	Address	1034	
	Function	This parameter sets the time that must elapse from the last alarm tripped to prompt the resetting of the autoreset attempts counter.	

C035 Autoreset at Power On

C035	Range	0 ÷ 1	No; Yes
Autoreset at Power On	Default	0	No
	Level	ADVANCED	
	Address	1035	
	Function	This parameter enables the autoreset at power on of the active alarms stored at the last inverter power off.	

C036 Thermal Protection Autoreset Enable

C036	Range	0 ÷ 1	No; Yes
Thermal Protection Autoreset Enable	Default	1	Yes
	Level	ADVANCED	
	Address	1036	
	Function	This parameter enables the autoreset of the overload alarm A074.	

C037 Heatsink Overheating Autoreset Enable

C037	Range	0 ÷ 1	No; Yes
Heatsink Overheating Autoreset Enable	Default	1	Yes
	Level	ADVANCED	
	Address	1037	
	Function	This parameter enables the autoreset function for the Heatsink Overheating alarm A094.	

C038 IGBT Fault Autoreset Enable

C038	Range	0 ÷ 1	No; Yes
IGBT Fault Autoreset Enable	Default	1	Yes
	Level	ADVANCED	
	Address	1038	
	Function	This parameter enables the autoreset function for the IGBT Fault alarm A053.	

C039 Overcurrent Autoreset Enable

C039	Range	0 ÷ 1	No; Yes
Overcurrent Autoreset Enable	Default	1	Yes
	Level	ADVANCED	
	Address	1039	
	Function	This parameter enables the autoreset function for the Software Overcurrent alarm A044.	

C040 Overvoltage Autoreset Enable

C040	Range	0 ÷ 1	No; Yes
Overvoltage Autoreset Enable	Default	1	Yes
	Level	ADVANCED	
	Address	1040	
	Function	This parameter enables the autoreset function for the Overvoltage alarm A048.	

C041 Serial Link Fault Autoreset Enable

C041	Range	0 ÷ 1	No; Yes
Serial Link Fault Autoreset Enable	Default	0	No
	Level	ADVANCED	
	Address	1041	
	Function	This parameter enables the autoreset function for the Serial Link Fault alarm A061.	

C042 Ambient Overtemperature Autoreset Enable

C042	Range	0 ÷ 1	No; Yes
Ambient Overtemperature Autoreset Enable	Default	1	Yes
	Level	ADVANCED	
	Address	1042	
	Function	This parameter enables the autoreset function for the Control Board Ambient Overtemperature alarm A067.	

C043 Cooling Time

C043	Range	0 ÷ 60000	0 ÷ 6000.0 s
Cooling Time	Default	9000	900.0 s
	Level	ADVANCED	
	Address	1043	
	Function	Cooling time before the inverter is restarted after the A094 Heatsink Overtemperature alarm has tripped.	

C044 PV Isolation Fault Control

C044	**Range**	0 ÷ 4	0: Alarm OFF 1: Warning ON 2: Alarm ON 3: Positive earth PV 4: Negative earth PV
PV Isolation Fault Control	**Default**	1	1: Warning ON
	Level	ADVANCED	
	Address	1044	
	Function	This parameter allows selecting the operating mode of the PV Field Isolation KO (A068). If C044 = 0, the detection of a PV field isolation fault has no effect on the inverter; if C044 = 1, the isolation fault prompts a warning (the inverter is not set to STOP mode); if C044 = 2, the inverter enters the ALARM mode when an isolation fault is detected. C044 = 3 or 4 states the type of PV field connected to the inverter. When the inverter is connected to a Positive earthed or Negative earthed PV field and a 'floating PV field' condition is detected (which is considered here as a fault), warning W29 is activated (PV. POLAR KO), which informs the user that the field polarisation is no longer detected (i.e. the condition conflicts with the type of field that is connected). When C044 = 3, warning W30 (PV ISOLATION + KO) is activated upon detecting a condition of PV field with negative pole grounded; when C044 = 4 and the positive pole of the PV field is grounded, warning W31 (PV ISOLATION - KO) is activated.	

C045 Isolation Fault Autoreset Enable

C045	**Range**	0 ÷ 1	No; Yes
Isolation Fault Autoreset Enable	**Default**	1	Yes
	Level	ADVANCED	
	Address	1045	
	Function	This parameter enables the autoreset function for the Isolation Fault alarm (A068).	

C046 Buzzer On-Alarm Enable

C046	**Range**	0 ÷ 1	No; Yes
Buzzer On-Alarm Enable	**Default**	1	Yes
	Level	ADVANCED	
	Address	1045	
	Function	This parameter enables alarm signalling via the display/keypad buzzer.	

5.4.4. EEPROM MENU

The inverter has four different memory zones:

- **RAM** Volatile memory containing the parameterization of the inverter currently in use.
- **Default Zone** Non-volatile memory that cannot be accessed by the user. It contains the factory-setting of the inverter parameters.
- **Work Zone** Non-volatile memory where customized parameters are saved. Whenever the inverter is reset, this parameterization is loaded to the RAM.
- **Back-up Zone** Non-volatile memory where it is possible to store a new parameterization of the inverter. Back-up parameters are modified only when the user explicitly saves again the back-up zone.

The following types of parameters are available:

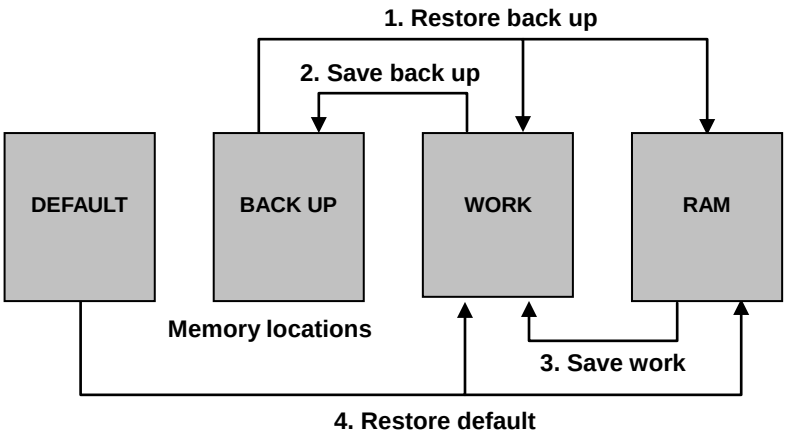
- **'P'** parameters, which can be written at any moment.
- **'C'** parameters, which can be written only if the inverter is in STOP mode.
- **'R'** parameters, which have the same features as 'C' parameters. However, when editing the 'R' parameters, the new parameter value, once saved, will be implemented only at next power on. Therefore, for the change to take effect, it is necessary to turn off and on again the inverter.

The user may command storing a customized parameter value to the Work zone; if the customized parameter value is not stored, the old parameter value stored to the Work area will be used when the inverter is next powered on.

The Work zone may be copied to the BACKUP zone through an **I012** command included in the Eeprom menu and described in the section below.

The **I012** command also allows copying the Backup zone to the WORK zone to restore the parameter values stored in the WORK zone.

Finally, the **I012** command also allows restoring the factory-settings (default configuration) for all the parameters in the WORK zone.



List of the programmable inputs

Input	Function	Access Level	Modbus Address
I012	EEPROM Control	ADVANCED	1399

Table 78: List of the inputs of the Eeprom menu

I012 EEPROM Control

I012	**Range**	0 ÷ 4 .6	0: No Command 1: Restore Backup 2: Save Backup 3: Save Work 4: Restore Default 6: Erase Fault List
EEPROM Control	**Default**	This is not a parameter: I012 is set to zero at power on and whenever the command is executed.	
	Level	ADVANCED	
	Address	1399	
	Function	This parameter allows managing the storage and restoring of the whole set of parameters that can be accessed by the user: **1**: **Restore Backup**: The parameters stored in the Backup zone are copied and stored to the WORK zone, where they serve as the new RAM parameterization; the previous data of the Work zone are cleared. **Backup ® RAM ® Work.** **2**: **Save Backup**: The parameters in the WORK zone are stored to a copy in the Backup zone. **Work ® Backup** **3**: **Save Work**: The current values of the parameters in the RAM are saved to the non-volatile memory in the Work zone. All parameters are saved at a time. **RAM ® Work.** **4**: **Restore Default**: Factory-setting values are restored for all parameters, and the factory-setting values are stored to the non-volatile memory in the Work zone. **Default ® RAM ® Work** **6: Erase Alarm Log:** Deletes the Fault List.	

5.4.5. SERIAL LINKS MENU R001 ÷ R006

The SUNWAY M PLUS is provided with an optional serial link called Serial Link 0, which implements the 2-wire RS485 electric standard, to ensure a better immunity to disturbance even on long cable paths, thus reducing communication errors. The communications standard implemented is the Modbus RTU.

For the physical connection to the serial link, refer to section 3.2 Serial Communications.

During the communications the inverter typically behaves as a Slave device (i.e. it only answers to queries sent by another device). A master device (typically a computer or a Data Logger board) is then needed to implement serial communications.

The parameters included in the Serial Links menu allows configuring:

1. The Modbus address of the inverter.
2. The inverter response delay to a query sent by the Master device.
3. The baud rate of the serial link (expressed in bits per second).
4. The time added to the 4 byte–time.
5. The serial link watchdog (which is active if the relevant parameter is other than 0).
6. The type of parity used for serial communications.

NOTE

The parameters included in this menu are R-type parameters.

Once the new parameter values have been saved, they become active only upon next power on of the inverter.

Alarms prompted by the WATCHDOG

The watchdog alarms for serial link communication are:

- A061 Serial Link n.0 WDG Alarm.
- A081 Display/Keypad Watchdog.

Alarm A061 trips when no valid message is sent from the serial link to the inverter for a time longer than the time set in the relevant watchdog parameter (R005; factory setting is ‘disabled’, i.e. R005=0).

Alarm A081 trips only if the display/keypad detects a communication loss for a time longer than 2 seconds.

List of Special Codes

Code		Description
0x01	ILLEGAL FUNCTION	The function sent by the Master is different from 0x03 (Read Holding Registers) and from 0x10 (Preset Multiple Registers).
0x02	ILLEGAL ADDRESS	The reading/writing address used by the Master is illegal.
0x03	ILLEGAL DATA VALUE	The numeric value that the Master attempted to write is not in the correct Range.
0x06	DEVICE BUSY	The inverter could not acknowledge the Master’s attempt to write (for example, because the inverter is in Run mode with a parameter of the Cxxx type).

Code		Description
0x07	ANOTHER USER WRITING	Other users were writing on the same parameter when the Master attempted to write (for example, Display in editing mode).
0x09	BAD ACCESS LEVEL	The Master tried to write a parameter which is not included in the current access level (for example, an attempt was made to write an ADVANCED parameter with a BASIC level).

Parameter	Function	Access Level	Modbus Address
R001	Inverter Modbus Address for Serial Link 0	ADVANCED	588
R002	Response Delay for Serial Link 0	ADVANCED	589
R003	Baud Rate for Serial Link 0	ADVANCED	590
R004	Time Added to 4-byte-time for Serial Link 0	ADVANCED	591
R005	Watchdog Time for Serial Link 0	ADVANCED	592
R006	Parity Bit for Serial Link 0	ADVANCED	593

Table 79: List of the parameters in the Serial Links menu R001 ÷ R006

R001 Inverter Modbus Address for Serial Link 0

R001	**Range**	1 ÷ 247	
Inverter Modbus Address for Serial Link 0	**Default**	1	
	Level	ADVANCED	
	Address	588	
	Function	This parameter sets the address of the serial link 0 assigned to the inverter networked through RS485 (9-pole male D connector).	

R002 Response Delay for Serial Link 0

R002	**Range**	1 ÷ 1000	1 ÷ 1000 ms
Response Delay for Serial Link 0	**Default**	5	5 ms
	Level	ADVANCED	
	Address	589	
	Function	This parameter sets the inverter response delay after a query sent by the Master through serial link 0 (9-pole male D connector).	

R003 Baud Rate for Serial Link 0

R003	**Range**	1 ÷ 7	1: 1200 bps 2: 2400 bps 3: 4800 bps 4: 9600 bps 5: 19200 bps 6: 38400 bps 7: 57600 bps
Baud Rate for Serial Link 0	**Default**	6	6: 38400bps
	Level	ADVANCED	
	Address	590	
	Function	This parameter sets the transmission rate, expressed in bits per second, for serial link 0 (9-pole male D connector).	

R004 Time Added to 4-byte-time for Serial Link 0

R004	**Range**	1 ÷ 10000	1 ÷ 10000 ms
Time Added to 4-byte-time for Serial Link 0	**Default**	2	2 msec
	Level	ADVANCED	
	Address	591	
	Function	This parameter sets the limit time after which, if no more characters are received from serial link 0 (9-pole male D connector), the message sent from the Master to the inverter is considered as finished.	

R005 Watchdog Time for Serial Link 0

R005	**Range**	0 ÷ 65000	0 ÷ 6500.0 s
Watchdog Time for Serial Link 0	**Default**	0	0.0 sec
	Level	ADVANCED	
	Address	592	
	Function	If this parameter is other than zero, it sets the limit time after which the alarm A061 WDG Serial Link 0 Alarm trips if the inverter does not receive any legal message via serial link 0 (9-pole male D connector). If R005 is set to zero, Alarm A061 is disabled.	

R006 Parity Bit for Serial Link 0

R006	**Range**	0 ÷ 3	0: Disabled 1 STOP–bit 1: Disabled 2 STOP–bit 2: Even (1 STOP bit) 3: Odd (1 STOP bit)
Parity Bit for Serial Link 0	**Default**	1	1: Disabled 2 STOP–bit
	Level	ADVANCED	
	Address	593	
	Function	This parameter sets whether the parity bit is used or not when creating the Modbus message via serial link 0 (9-pole male D connector).	

5.5. IDP MENU [IDP]

5.5.1. Description

The IDP menu contains the parameters relating to the product identification data, the working time of the inverter and the user language for the Display/Keypad module.

Product Menu

The Product menu includes the inverter size and voltage class, the type of control that is currently selected and the software version implemented for the certification of the connection to the Italian LV grid.

It also includes the Supply Time (ST) and the Operation Time (OT) of the inverter, as well as the following data relating to the inverter: name of the manufacturer, serial number, SW versions, inverter status, active alarms and hardware status.

Lastly, this menu includes the parameters for the user language selection.

5.5.2. PRODUCT MENU

The Product menu contains the information about the product and parameter **P263 Language**, allowing choosing the user language for the display/keypad module.

Information about the product is the following:

Language	editable
Manufacturer	(read-only)
Product name and size	(read-only)
Type	(read-only)
SW Version	(read-only)
Serial Number	(read-only)
Production Lot	(read-only)
Inverter Functioning Times	(read-only)
Country Settings	(read-only)

P263 Language

P263	**Range**	0 ÷ 4	0: ITALIANO 1: ENGLISH 2: ESPANOL 3: FRANÇAIS 4: DEUTSCH
	Default	See “Certification and Grid Interface File”.	
	Level	BASIC	
	Address	863	
	Function	Italian is the default user language for the display/keypad module. Parameter **P263** allows selecting a different one.	

Manufacturer

It states the name of the manufacturer, Elettronica Santerno SpA.

E L E T T R O N I C A **S A N T E R N O** **I M O L A (B O)** **I T A L Y**

Manufacturer	**Function**	This screen displays the Name of the inverter manufacturer.

Product Identification Page

The Product menu contains the inverter size and the software version implemented for the certification of the connection to the Italian LV grid.

```
SUNWAY_MPLUS3600
  GRID CONNECTED
  SOLAR INVERTER
Sw_Version 1.66
```

Inverter Size	**Range**	0=2600E 1=3600 2=4300 3=5300 4=6000/6400 5=7500/7800 6=3600E 7=4300E 8=1300E	1300E, 2600E, 3600, 3600E, 4300, 4300E, 5300, 6000, 7500, 6400, 7800
	Address	482	
	Function	Inverter size. **NOTE:** The 'E' suffix is not displayed in the Product ID screen.	

Lines 1-3 of the display/keypad show the product name and the inverter size (3600 in the example above).

Line 4 shows the software version related to the certification for the connection to the Italian LV grid.

The PROD ID (Product Identifier) as well is available via serial link. It is the acronym for the name of the device encoded in ASCII hexadecimal format.

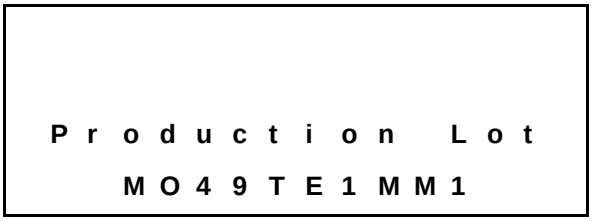
PROD ID: Product Identifier

PROD ID	**Product**	Sunway SP	
Product Identifier	**Value**	0x5350 (hexadecimal) S:0x53, P:0x50 (ASCII encoding)	SP
	Address	476	
	Function	Product Identifier. This measure represents the two hexadecimal characters that identify the product.	

Serial Number

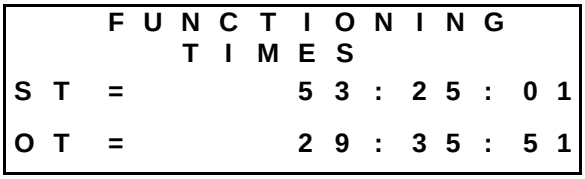
Serial Number	**Function**	This screen displays the serial number of the inverter.

Production Lot



Production Lot	Function	This screen displays the production lot of the inverter.

Inverter Functioning Times



Lines 3 and 4 show the inverter supply time (ST) and operation time (OT) expressed in hours:minutes:seconds (the operation time is the time during which the IGBTs are on).

Functioning Times	Range	0 ÷ (2^{32}-1) in units of 200 ms	0 ÷ (2^{32}-1) in units of 200 ms
	Address	1915 (Long word)	1917 (Long word)
	Function	ST: Supply Time	OT: Operation Time

Country Settings

Country Settings	Function	It shows the geographical references, which affect the parameter settings.

5.6. ITALIAN GRID INTERFACE PROTECTION SELF-TEST FUNCTION

5.6.1. Description

This function allows checking the operation of the grid disconnecting device (interface protection device) as required by the Italian Grid Administrator ("Guida per le Connessioni alla rete elettrica di Enel Distribuzione, Ed. I - 1/213, December 2008).

The following tests can be performed:

- Checking protection trip due to min voltage fault.
- Checking protection trip due to max voltage fault.
- Checking protection trip due to min frequency fault.
- Checking protection trip due to max frequency fault.

When testing, the inverter automatically shifts the trip threshold until the protection trips because the detected value is the same as the threshold, thus allowing checking if the contactor connecting the inverter to the grid actually opens when required. When this happens, the inverter stops, the interface contactor opens and the trip threshold stops changing and is kept constant to the trip level. At the same time, the trip time of the interface protection is displayed.

After a few seconds, the inverter automatically restarts and the default values are restored.

The inverter disconnecting events after each test stage are stored to the **Event List**.

5.6.2. Test Procedure

The inverter must be running and connected in parallel to the grid (RUN and Grid OK LEDs ON).

By selecting the menu GRID INTERFACE SELF-TEST MENU I030 ÷ I033, in the PAR menu, the display will show:

I	**0**	**3**	**0**		**T**	**E**	**S**	**T**		**V**	**m**	**i**	**n**	
M	**0**	**0**	**4**	**=**		**y**	**y**	**y**		**V**		**t**	**m**	**s**
T	**E**	**S**	**T**	**=**		**3**	**2**	**0**		**V**				**0**
					=	**I**	**n**	**a**	**c**	**t**	**i**	**v**	**e**	

By using the arrow keys, it is possible to navigate through the test pages.

IO30 Test V Min
M004 = yyy
Test = 184 V
IO30 = Inactive

IO31 Test V Max
M004 = yyy
Test = 276 V
IO31 = Inactive

IO32 Test Fmin
M005 = www
Test = 49.7 Hz
IO32 = Inactive

IO33 Test FMax
M005 = www
M077 = 50.3 Hz
IO33 = Inactive

When the test procedure is inactive, the trip thresholds are stable and set to the values required by the standards in force.

Parameter	Ratings Prescribed	Factory-set Rated Value	Factory-set Trip Threshold
Min voltage value causing protection trip	0.8* rated grid voltage	230 Vac	184Vac
Max voltage value causing protection trip	1.2* rated grid voltage	230 Vac	276Vac
Min frequency value causing protection trip	49.7 Hz (49 Hz) (*)	50 Hz	49.7 Hz
Max frequency value causing protection trip	50.3 Hz (51 Hz) (*)	50 Hz	50.3 Hz

(*) In special cases, the Grid Administrator may require to change the ratings in brackets. Should this happen, please contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

The trip times of the protection devices are as follows:

Parameter	Time
Max voltage trip time	50 ms
Min voltage trip time	50 ms
Max frequency trip time	50 ms (**)
Min frequency trip time	50 ms (**)

The trip times that can be checked with the self-test function are the same as the times stated in the table above. Negligible errors may be accepted.

(**) The actual trip time of the minimum frequency/maximum frequency interface protection is 90 ms, as it includes an insensitivity time of 40 ms as prescribed by the regulations in force.

The TEST procedure is as follows:

- Using the arrow keys Ù Ú select the test to be performed.
- Using the ENTER key, enable the editing of the test status.
- Using the arrow key Ù set the value to Active.
- Using the ESC key, enable the testing: the trip time starts shifting until it matches the value being measured.
- If the test is SUCCESSFUL, the inverter stops, the RUN Led turns off for a few seconds and the display shows the trip threshold that caused the inverter to stop. The trip time for the interface protection is displayed below 'tms'.

- If the test FAILS, the inverter is not stopped. This is due to a malfunctioning of the interface protection. Please contact Elettronica Santerno SpA's AFTER-SALES SERVICE.

To quit the test mode, press the ESC key repeatedly until the start menu is displayed again.

6. MAINTENANCE

The SUNWAY M PLUS requires no specific maintenance, since its level of protection ensures continuity of operation.

In order to maintain optimal operating conditions, it is advisable to carry out annual cleaning of the cooling vents and filters of the inverter (if any). This is necessary even in case of overheating.

The cleaning should be done not only on the grid installed at the end of the vents, but also on the filter inside the equipment. To remove the filter, simply remove the two screws on the sides of the vents, pull out the fabric filter, wash it with water and then let it dry naturally (see Figure 74: View of the cooling vents).

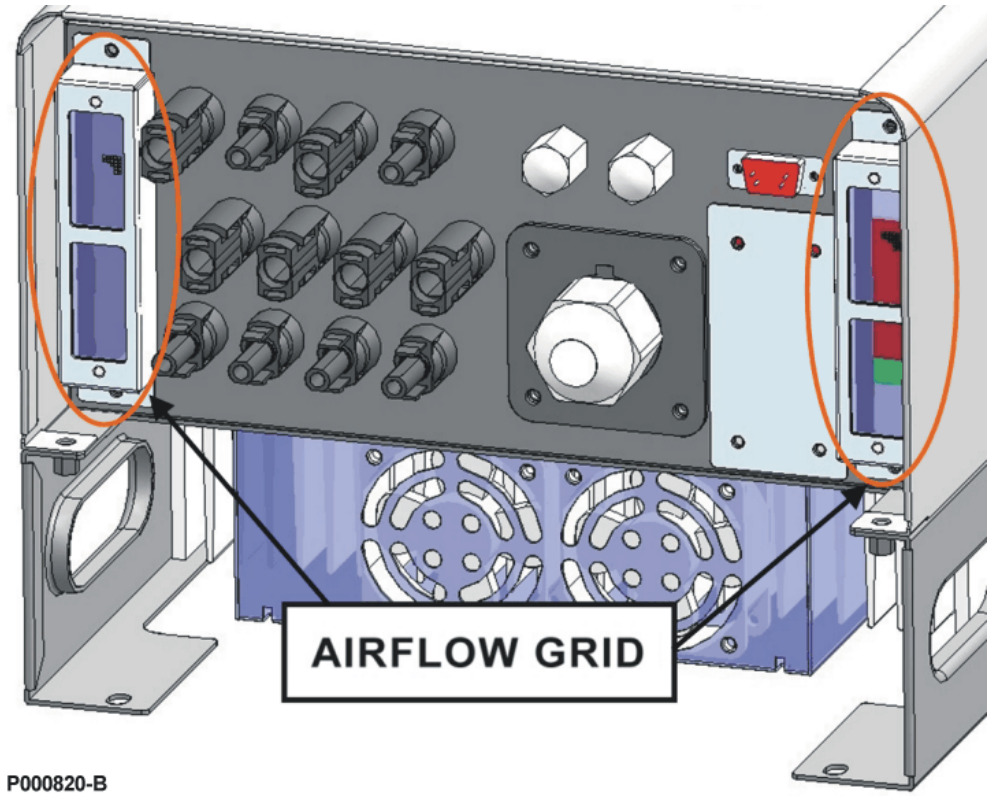


Figure 74: View of the cooling vents

DANGER

When cleaning the ventilation system, take great care not to touch live wires. It is recommended to do the cleaning with the inverter turned off, after disconnecting the strings attached to the SUNWAY M PLUS and removing the auxiliary power supply, if present.

There is a risk of electric shock even when the inverter is not powered, until the capacitors are fully discharged. Before accessing the inverter, wait at least 10 minutes after the complete powering off of the equipment.

7. TECHNICAL SPECIFICATIONS

NOTE

SUNWAY M PLUS 6000 and SUNWAY M PLUS 7500 is available for purchase only in those countries that implement the grid-connection standard VDE 126-1-1.

7.1. Installation Specifications

Installation Specifications for M PLUS	
Ambient temperature for operation	-25 ÷ +40°C
Max. ambient temperature for operation [°C]	-25 ÷ +60°C (see Figure 75)
Ambient humidity for operation	From 5 % to 95 % at 20 °C, from 1 g/m^3 to 25 g/m^3, without condensation or formation of ice (class 3k3 according to EN50178)
Altitude	Up to 1000 m a.s.l. For altitudes higher than 1000 m a.s.l., refer to the “Installation and Programming Guide”.
Installation site	Do not install in direct sunlight and in places exposed to conductive dust, corrosive gas, vibrations; do not install in salty environments.
Pollution degree	2 or higher.

Table 80: Installation Specifications for M PLUS

7.2. General Specifications

SUNWAY M PLUS Grid Connected Solar Inverter	
Electric Specifications, AC Side	
AC rated voltage [V]	230V ±15 % single-phase
Grid frequency	50 Hz (60 Hz upon request) ±5 Hz
Short-circuit rated current*	1.5In
Power factor	>0.99
Output current total distortion	<3 %
General Data	
Conversion bridge	IGBT
Grid interface relay	Song Chuan 832A1A-C 24 Vdc 30A Single Pole – Normally Open UL/CUL (UL 508 & 873),VDE
Isolation transformer	Single-phase, toroidal
Isolation voltage to ground	2.5 kV
Isolation voltage between input and output	2.5 kV
Overvoltage protections	Installed on each input polarity of the PV field Imax 8/20 uS = 8 kA max clamping voltage = 1.2 kV
Isolation loss integrated detecting device	Individual control of each polarity; possibility to set the min. impedance to ground and trip time. Factory-setting: enabled (can be disabled by the user).
Noise at 1m within the rage 16 Hz ÷ 20 kHz [dB]	65
* The actual value depends on the real operating conditions of the grid.	
** When exceeding an ambient temperature of 40 °C, the SUNWAY M PLUS automatically decreases the delivered power to prevent overheating (see Figure 75: Power derating).	

Table 81: Electrical specifications

7.3. Specifications of the Serial Link Communication

Specifications of the Serial Link RS485	
Baud rate:	Configurable between 1200..57600 bps (default 38400 bps)
Data format:	8 bit
Start bit:	1
Parity: (1)	NO, EVEN, ODD
STOP bit:	2.1
Protocol:	Modbus RTU
Supported functions:	03h (Read Holding Registers) 10h (Preset Multiple Registers)
Device address:	Configurable between 1 and 247 (default 1)
Electric standard:	RS485
Inverter response delay:	Configurable between 0 and 1000 ms (default: 5 ms)
End of message time-out:	Configurable between 0 and 10000 ms (default: 0 ms)
Communication watchdog (2)	Configurable between 0 and 65000 s (default: disabled)

Table 82: Specifications of the Serial Link RS485

(1) Ignored when receiving communication messages

(2) If set up, it prompts an alarm

Specifications of the Serial Link RS485	
Baud rate:	Configurable between 1200..115200 bps (default 38400 bps)
Data format:	8 bit
Start bit:	1
Parity: (1)	NO, EVEN, ODD (default NO)
STOP bit:	2.1 (default 2)
Protocol:	Modbus RTU
Supported functions:	03h (Read Holding Registers) 10h (Preset Multiple Registers)
Device address:	Configurable between 1 and 128 (default 1)
Electric standard:	RS232
Waiting time between packets:	Configurable between 0 and 50 ms (default 20 ms)
Time-out:	Configurable between 0 and 1000 ms (default 500 ms)

Table 83: Specifications of the Serial Link RS232

(1) Ignored when receiving communication messages

7.4. Rated Power Derating

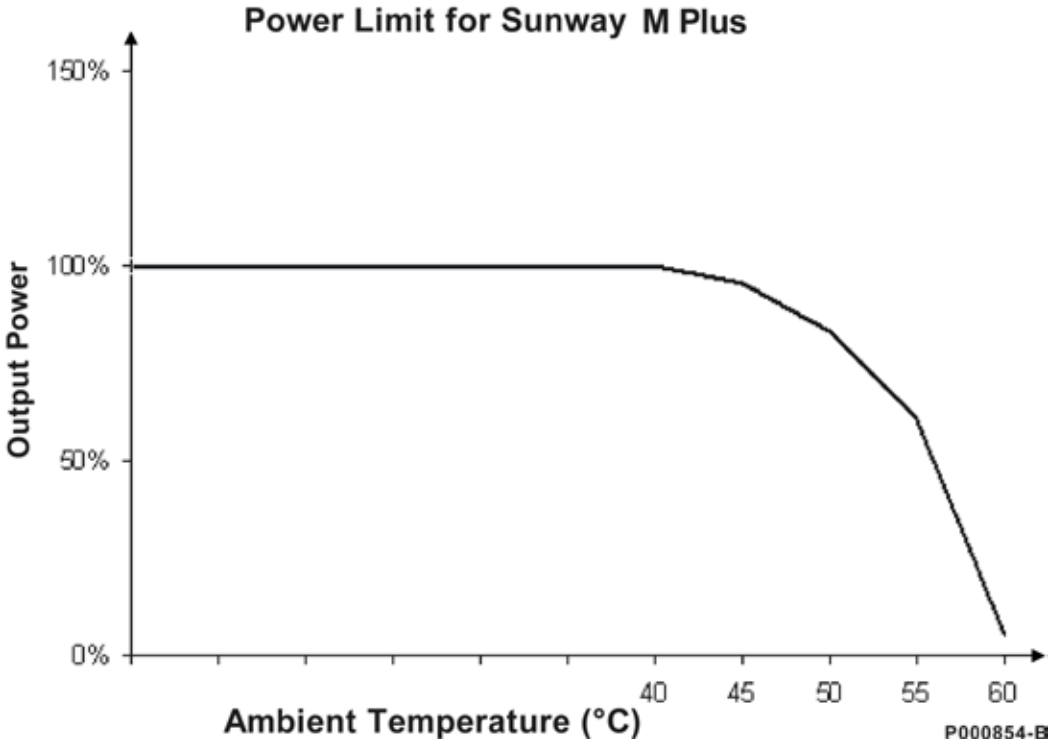


Figure 75: Power derating according to temperature

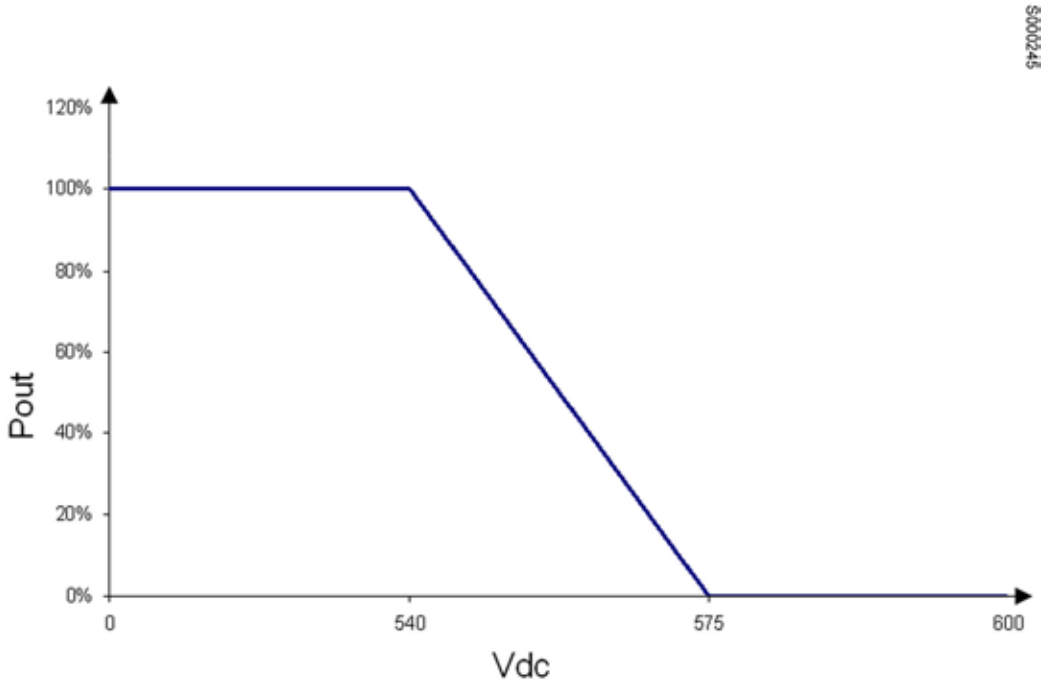


Figure 76: Derating for PV-field high voltages

7.5. Power Cables Connection

Model	*1300E*	*2600E*	*3600*	*3600E*	*4300*	*4300E*	*5300*	*6000*	*6400*	*7500*	*7800*
Input Cables – DC Side											
Type of connectors	Quick-coupling PV connectors, MC4-type PV-KBT4/6I:male, negative polarity PV-KST4/6I: female, positive polarity										
Cross-section compatible with the quick-coupling MC4 PV connectors [mm^2]	4-6										
Stripping length [mm]	10										
Output Cables – AC Side											
Output cable cross-section [mm^2]	4	4	4	4	4	4	6	6	6	6	6
Output cable type	Three-pole with double isolation (phase+neutral+ground)										
External diameter of the connection cable [mm]	9-16										

Table 84: Specifications for input/output cables

7.6. Electrical Input/Output Connections

Model	*1300E*	*2600E*	*3600*	*3600E*	*4300*	*4300E*	*5300*	*6000*	*6400*	*7500*	*7800*
Connection to the PV Generator											
Recommended peak power of the PV field [Wp]	1263	2410	3310	3310	3950	3950	4920	5525	5880	6900	7180
Max input current [A]	12	14	11.50	18.80	13.8	22.3	16.9	20.4	25	12	14
MPP voltage range for PV1 [V]	105-380	156-585	260-585	156-585	260-585	156-585	260-585	260-585	260-585	260-585	260-585
MPP voltage range for PV2 [V]	-	24-486	24-486	24-486	24-486	24-486	24-486	24-486	24-486	24-486	24-486
Max no. of input strings	1	4	4	4	4	4	4	4	4	4	4
Max voltage Voc [V]	420	600	600	600	600	600	600	600	600	600	600
Power on thresholds for the control electronics of the display/keypad module [V]	105	180	300	180	300	180	300	300	300	300	300
Field voltage for starting [V]	190	260	300	260	300	260	300	300	300	300	300
Connection to the Grid											
Rated AC output power [W]	1035	2010	2760	2760	3290	3290	4100	4600	4900	5750	5980
Rated output current [A]	4.5	8.7	12.0	12.0	14.3	14.3	17.8	20	21.3	25	26
Efficiency											
Max efficiency [%]	92.5	93.6	94.4	93.0	94.8	93.4	96.0	96.0	96.0	95.8	95.8
European efficiency [%]	91.8	92.0	92.6	92.0	93.1	92.4	94.1	94.1	94.1	93.9	93.9
Protection Circuit Breaker											
Rated current of the protection circuit breaker [A]	6	10	16	16	16	16	20	25	25	32	32

Table 85: Input/output electrical specifications

7.7. Mechanical Specifications

Model	*1300E*	*2600E*	*3600*	*3600E*	*4300*	*4300E*	*5300*	*6000*	*6400*	*7500*	*7800*
General Data											
Dimensions LxAxP [mm]	290x710x230									290x710x247	
Weight [kg]	39	42	45	55	45	55	55	55	55	63	63
Cooling fans	NO	NO	NO	YES	NO	YES	YES	YES	YES	YES	YES
Protection degree	IP65	IP65	IP65	IP54	IP65	IP54	IP54	IP54	IP54	IP54	IP54
Weight and dimensions may vary according to the options requested.											

Table 86: General data

7.8. Control Board Terminal Board

Connection to the control board is required to:

- Measure and/or acquire ambient variables.
- Implement an external Grid Interface Protection Device.
- Connect more than 3 inverters to the same plant (multi-inverter connection configuration).

To access the terminal board of the control board it is necessary to remove the cover of the equipment (see 3.1.1 Accessing the Terminal Boards).

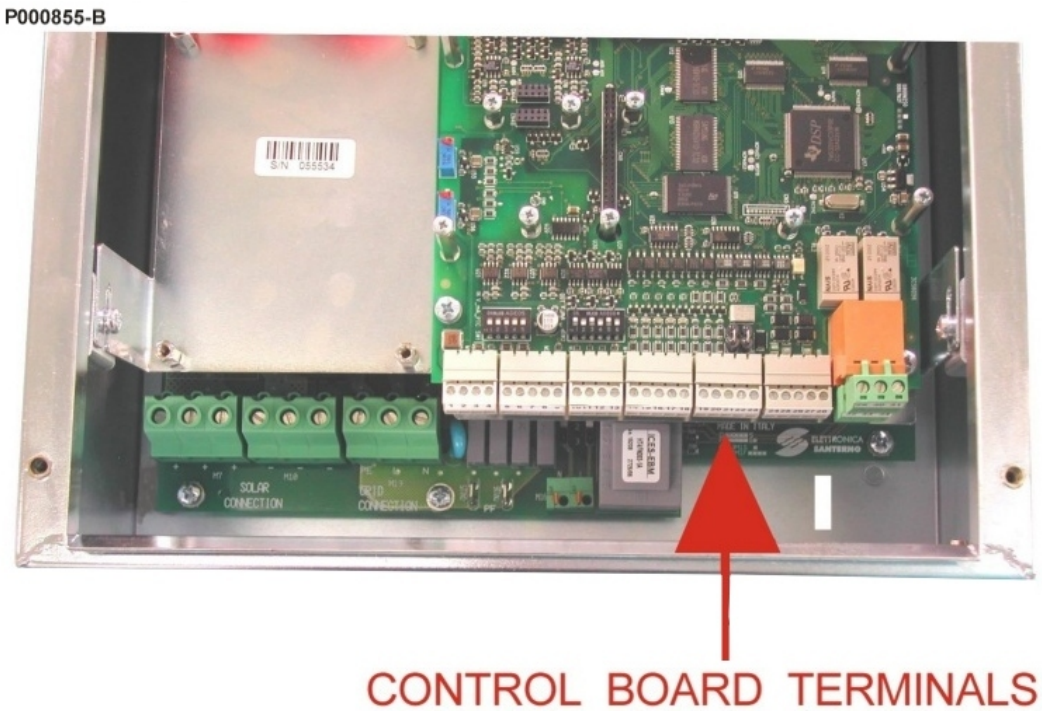


Figure 77: Location of the control board terminal board

The control board is fitted with two screw-terminal boards: one terminal board divided into six sections and compatible with cables 0.08 ÷ 1.5mm^2 (AWG 28-16), and a second terminal board divided into two sections and compatible with cables 0.2 ÷ 2.5mm^2 (AWG 24-12). The two terminal boards are separate and can be removed independently from each other.

The following table describes the inputs and outputs of the terminals.

No.	Name	Description	I/O Specifications	Dip Switch
1	CMA	0 V for main reference (connected to the control 0 V)	Control board 0 V	
2	REF	Input for ambient signal 1, to be configured either as a voltage input or as a current input	Vfs = ±10 V, Rin: 50 kW; Resolution: 12 bit	SW1-1: Off
			0 (4) ÷ 20 mA, Rin = 250 W; Resolution: 11 bit	SW1-1: On
3	-10VR	Output for -10 V negative power supply	-10 V Imax: 10 mA	
4	+10VR	Output for +10 V positive power supply	+10 V Imax: 10 mA	
5	AIN1+	Differential analogue input for ambient signal 2, to be configured either as a voltage input or as a current input	Vfs = ±10 V, Rin: 50 kW; Resolution: 12 bit	SW1-2: Off
6	AIN1-		0 (4) ÷ 20 mA, Rin = 250 W; Resolution: 11 bit	SW1-2: On
7	AIN2+	Analogue input for ambient signal 3, to be configured either as a voltage input or as a current input	Vfs = ±10 V, Rin: 50 k W; Resolution: 12 bit	SW1-3: Off SW1-4.5: Off
8	AIN2-		0 (4) ÷ 20 mA, Rin = 250 W; Resolution: 11 bit	SW1-3: On SW1-4.5: Off
9	CMA	0 V for auxiliary inputs (connected to the control 0 V)		
10	AO1	**NOT USED IN THIS APPLICATION**		
11	AO2	**NOT USED IN THIS APPLICATION**		
12	AO3	**NOT USED IN THIS APPLICATION**		
13	CMA	0 V for analogue outputs (connected to the control 0 V)		
14	START (MDI1)	**NOT USED IN THIS APPLICATION**		
15	ENABLE (MDI2)	Active input: inverter enabled. Inactive input: inverter disabled. IMPORTANT: this terminal must be kept connected to terminal 23		
16	RESET (MDI3)	**NOT USED IN THIS APPLICATION**		
17	MDI4	In the multi-inverter configuration with power output higher than 4.6 kW (M PLUS 7500), this digital input is used by the EquiPhase Control function, to limit the power to 4.6 kW in case of phase unbalance.		

No.	Name	Description	I/O Specifications	Dip Switch
18	MDI5	In the multi-inverter configuration with power output higher than 4.6 kW (M PLUS 7500), this digital input is used by the EquiPhase Control function, to limit the power to 4.6 kW in case of phase unbalance.		
19	MDI6	**NOT USED IN THIS APPLICATION**		
20	MDI7	**NOT USED IN THIS APPLICATION**		
21	MDI8	**NOT USED IN THIS APPLICATION**		
22	CMD	Digital inputs 0 V, isolated with respect to the control 0 V	Optoisolated digital inputs zero volt.	
23	+24V	Auxiliary supply output for optoisolated multifunction digital inputs	+24 V±15 % ; Imax: 100 mA Protected by resettable fuse	
24	+VMDO1	Supply input for MDO1 output.	20 ÷ 48 Vcc; Icc = 10 mA + output current (max 60 mA)	
25	MDO1 /FOUT	Multifunction digital output 1; frequency output. In the multi-inverter configuration with M PLUS 7500), this digital output is used by the EquiPhase Control function to prompt the other inverters to decrease their power outputs, in order to limit the max phase unbalance to 4600W.	Optoisolated digital output of the push-pull type; Iout = 50 mA max; fout max 100 kHz.	
26	CMDO1	0V multifunction digital output 1.	Common for supply and MDO1 output.	
27	MDO2	**NOT USED IN THIS APPLICATION**		
28	CMDO2	Common for multifunction digital output 2.	Common for multifunction output 2.	
29	MDO3-NC	**NOT USED IN THIS APPLICATION**		
30	MDO3-C	**NOT USED IN THIS APPLICATION**		
31	MDO3-NO	**NOT USED IN THIS APPLICATION**		
32	MDO4-NC	Multifunction relay digital output. User-programmable.	Changeover contact normally closed (NC)	
33	MDO4-C		Common signal	
34	MDO4-NO		Changeover contact normally open (NO)	

Table 87: Control board terminal board

7.8.1. Specifications of the Ambient Signals Inputs

Specification	Min.	Typ.	Max	Unit
Input impedance in voltage mode (REF input)	10			kΩ
Input impedance in voltage mode (differential inputs, AIN1-AIN2)		80		kΩ
Input impedance in current mode		250		Ω
Offset and gain cumulative error with respect to the full-scale value			0.25	%
Temperature coefficient of the offset and gain error			200	ppm/°C
Digital resolution in voltage mode			12	bit
Digital resolution in current mode			11	bit
Value of the voltage LSB		4.88		mV
Value of the current LSB		9.8		mA
Max. voltage in common mode of the differential inputs	-7		+7	V
Rejection ratio in common mode of the differential inputs at 50Hz	50			dB
Safe permanent overload in voltage mode	-50		50	V
Safe permanent overload in current mode	-23		23	mA
Cut-off frequency of the input filter (first dominant order) over ambient sensor 1		230		Hz
Cut-off frequency of the input filter (first dominant order) over ambient sensors 2 and 3		500		Hz
Sampling time	0.6		1.2	ms
Current that can be absorbed from the reference outputs			10	mA

Table 88: Technical specifications of the ambient signals

CAUTION

Exceeding the max and min input voltage/current causes irreparable damage to the equipment.

NOTE

Auxiliary voltage outputs are electronically protected against temporary short-circuits. After wiring the inverter, check that the voltage at the outputs is correct, as a permanent short-circuit can damage the equipment.

7.9. Options

Model	*1300E*	*2600E*	*3600*	*3600E*	*4300*	*4300E*	*5300*	*6000*	*6400*	*7500*	*7800*
Options Available											
Additional PV Field (PV2)	No	Yes									
Ambient Sensors and Field I/Os Expansion Board	No	Yes									
Data Logger Board	No	Yes									
GSM/GPRS Modem	Yes										
Auxiliary Power Supply	No	Yes									
Positive Earth	Yes										
Negative Earth	Yes										

Table 89: Options

7.10. Specifications of the Ambient Sensors and Field I/Os Expansion Board

Specifications	
Operating Temperature:	From 0 to + 50° C ambient temperature (if temperature exceeds the max value, please contact Elettronica Santerno SpA's AFTER-SALES SERVICE)
Relative Humidity:	From 5 to 95 % (without condensation)
Max Altitude for Operation	4000 (a.s.l.)

Table 90: Installation specifications for the Ambient Sensors and Field I/Os Expansion Board

Specification	Min	Typ	Max	Unit
Analogue inputs configured in 0 ÷ 10 V mode				
Input impedance		40		kΩ
Offset and gain cumulative error with respect to the full-scale value		0.5		%
Temperature coefficient of the gain error and offset			200	ppm/°C
Digital resolution			12	bit
Value of voltage LSB		2.44		mV/LSB
Permanent overload at the inputs with no damage	-30		+30	V
Input filter cut-off frequency (1st order low-pass filter)		1		Hz
Sampling time (depending on the application software being used)	10		1000	ms
Analogue inputs configured in 0 ÷ 20 mA mode				
Input impedance		124.5		Ω
Offset and gain cumulative error with respect to the full-scale value		0.5		%
Temperature coefficient of the gain error and offset			200	ppm/°C
Digital resolution			12	bit
Value of voltage LSB		4.90		µA/LSB
Permanent overload at the inputs with no damage	-3.7		+3.7	V
Input filter cut-off frequency (1st order low-pass filter)		1		Hz
Sampling time (depending on the application software being used)	10		1000	ms
Analogue inputs configured in 0 ÷ 100 mV mode				
Input impedance	1			MΩ
Offset and gain cumulative error with respect to the full-scale value		0.2		%
Temperature coefficient of the gain error and offset			50	ppm/°C
Digital resolution			12	bit
Value of voltage LSB		24.7		µV/LSB
Permanent overload at the inputs with no damage	-30		+30	V
Input filter cut-off frequency (1st order low-pass filter)		1		Hz
Sampling time (depending on the application software being used)	10		1000	ms
Analogue inputs configured in measure acquisition mode – Temperature detected through PT100				
Type of probe	PT100 thermal resistor, 2-wires connection			
Acquisition range	-50		125	°C

Specification	Min	Typ	Max	Unit
Polarization current for PT100		0.67		mA
Measure temperature coefficient			50	ppm/°C
Digital resolution			12	bit
Measure max cumulative error for temperature ranging from -40 to +50°C		0.5	1.5	°C
Mean value of temperature LSB (SW linearization function)		0.098		°C/LSB
Permanent overload over inputs with no damage	-10		+10	V
Input filter cut-off frequency (1st order low pass filter)		1		Hz
Sampling time (depending on the software being used)	10		1000	ms

Table 91: Electric specifications – Analogue inputs

Specifications	Min	Typ	Max	Unit
Specifications of the analogue power supply outputs				
Voltage available at the terminal +15 V (4) with respect to CMA (6)	14.25	15	15.75	V
Voltage available at the terminal -15 V (5) with respect to CMA (6)	-15.75	-15	-14.25	V
Max deliverable current from output +15 V and absorbable by output –15 V			100	mA
Specifications of the digital power supply outputs				
Voltage available on +24V terminals (44, 49) with respect to CMD (43, 50)	21	24	27	V
Max deliverable current from +24V output			200	mA

Table 92: Electric specifications – Power supply outputs

CAUTION

Exceeding the max. and min. input voltage/current causes irreparable damage to the equipment.

NOTE

The isolated supply output and the analogue auxiliary output are protected by a resettable fuse capable of protecting the power supply unit inside the inverter against short-circuits. However, this does not guarantee that, in case of short-circuit, the inverter is temporarily locked and the motor stopped.

The screw-terminal board is divided into 12 sections, which can be removed independently from each other and are compatible with cables 0.08 ÷ 1.5 mm^2 (AWG 28-16).

No.	Name	Description	I/O Specifications	Dip Switch/Notes
1-2		NOT USED – DO NOT CONNECT		
3	**CMA**	0V analogue inputs (common with control 0 V)	Control board zero volt	
4-5	**+15VM - 15VM**	Stabilized, bipolar supply output protected from short-circuit for external sensors.	+15V, -15V; Iout max: 100 mA	
6	**CMA**	0V analogue inputs (common with control 0 V)	Control board zero volt	
7-26		NOT USED – DO NOT CONNECT		
27	**XAIN8/ T1+**	Auxiliary analogue input AMBIENT MEASURE 4	Vfs = 10 V, Rin = 30 kΩ	SW1.3 = ON SW1.1-2-4 = OFF
			Vfs = 100 mV, Rin = 1 MΩ	SW1.4 = ON SW1.1-2-3 = OFF
			Ifs = 20 mA, Rin = 124.5 Ω	SW1.2 = ON SW1.1-3-4 = OFF
		Temperature measure of thermal resistor number 4	PT100 temperature acquisition	SW1.1-4 = ON SW1.2-3 = OFF
28	**CMA/T1-**	Analogue inputs 0V for XAIN8 return	Control board zero volt	
29	**XAIN9/ T2+**	Auxiliary analogue input AMBIENT MEASURE 5	Vfs = 10 V, Rin = 30 kΩ	SW1.7 = ON SW1.5-6-8 = OFF
			Vfs = 100 mV, Rin = 1 MΩ	SW1.8 = ON SW1.5-6-7 = OFF
			Ifs = 20 mA, Rin = 124.5 Ω	SW1.6 = ON SW1.5-7-8 = OFF
		Temperature measure of thermal resistor number 5	PT100 temperature acquisition	SW1.5-8 = ON SW1.6-7 = OFF
30	**CMA/T2-**	Analogue inputs 0V for XAIN9 return	Control board zero volt	
31	**XAIN10/T3+**	Auxiliary analogue input AMBIENT MEASURE 6	Vfs = 10 V, Rin = 30 kΩ	SW2.3 = ON SW2.1-2-4 = OFF
			Vfs = 100 mV, Rin = 1 MΩ	SW2.4 = ON SW2.1-2-3 = OFF
			Ifs = 20 mA, Rin = 124.5 Ω	SW2.2 = ON SW2.1-3-4 = OFF
		Temperature measure of thermal resistor number 6	PT100 temperature acquisition	SW2.1-4 = ON SW2.2-3 = OFF
32	**CMA/T3-**	Analogue inputs 0V for XAIN10 return	Control board zero volt	

No.	Name	Description	I/O Specifications	Dip Switch/Notes
33	***XAIN11/T4+***	Auxiliary analogue input AMBIENT MEASURE 7	Vfs = 10 V, Rin = 30 kΩ	SW2.7 = ON SW2.5-6-8 = OFF
			Vfs = 100 mV, Rin = 1MΩ	SW2.8 = ON SW2.5-6-7 = OFF
			Ifs = 20 mA, Rin = 124.5 Ω	SW2.6 = ON SW2.5-7-8 = OFF
		Temperature measure of thermal resistor number 5	PT100 temperature acquisition	SW2.5-8 = ON SW2.6-7 = OFF
34	**CMA/T4-**	Analogue inputs 0V for XAIN11 return	Control board zero volt	
35	**XAIN12**	Auxiliary analogue input AMBIENT MEASURE 8, 10 V f.s.	Fs = 10 V; Rin= 30 kΩ;	
36	**CMA**	Analogue inputs 0V for XAIN12 return	Control board zero volt	
37	**XAIN13**	Auxiliary analogue input AMBIENT MEASURE 9, 10 V f.s.	Fs = 10 V; Rin= 30 kΩ;	
38	**CMA**	Analogue inputs 0V for XAIN13 return	Control board zero volt	
39-40		NOT USED – DO NOT CONNECT		
41	**XMDI3**	Multifunction auxiliary digital input 3	External counter for delivered power	
42	**XMDI4**	Multifunction auxiliary digital input 4	External counter for absorbed power	
43	**CMD**	Digital inputs 0 V isolated with respect to control 0 V	Common	
44	**+24 V**	Aux. supply output for optoisolated multifunction digital inputs.	+24 V	
45-62		NOT USED – DO NOT CONNECT		

Table 93: Terminal board of the Ambient Sensors and Field I/Os Expansion Board

7.11. Additional PV Field Specifications

Model	*1300E*	*2600E*	*3600*	*3600E*	*4300*	*4300E*	*5300*	*6000*	*6400*	*7500*	*7800*
Max peak power recommended for the Additional PV Field [Wp]	-	2100	2100	2100	3200	3200	3200	3200	3200	3200	3200
Operating voltage of the PV generator [V]	-	24 ÷ 486	24 ÷ 486	24 ÷ 486	24 ÷ 486	24 ÷ 486	24 ÷ 486	24 ÷ 486	24 ÷ 486	24 ÷ 486	24 ÷ 486
Max voltage of the PV field [V]	-	600	600	600	600	600	600	600	600	600	600
Max current of the PV generator [A]	-	10	10	10	10	10	15	15	15	15	15

Table 94: Additional PV field specifications

8. DECLARATION OF CONFORMITY

See “CERTIFICATION AND GRID INTERFACE FILE”.